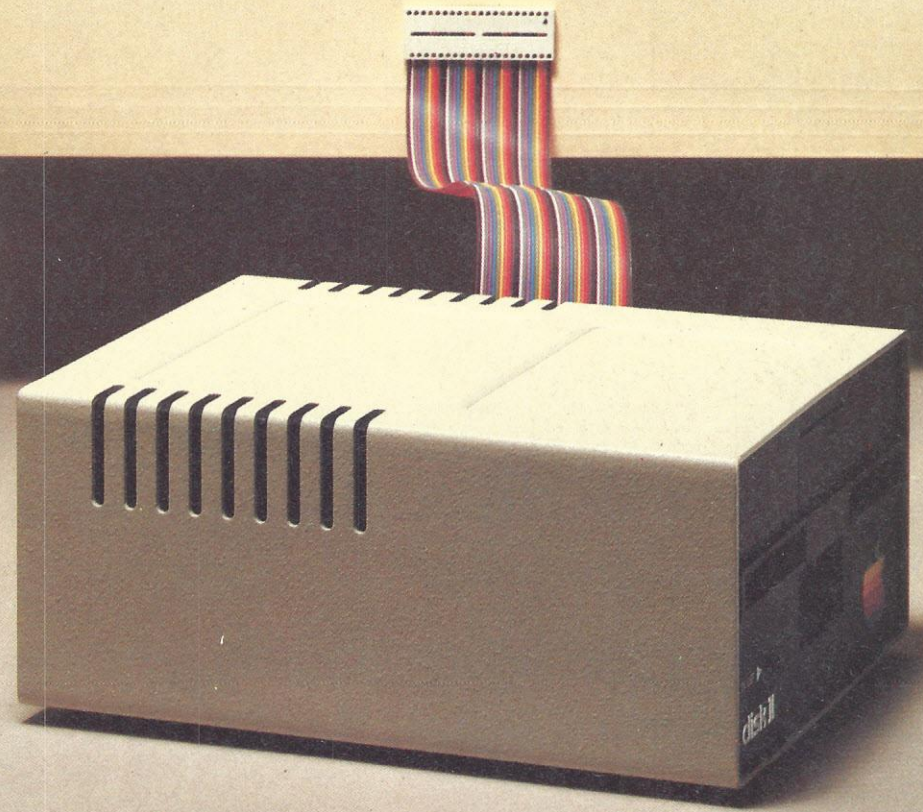
FEBRUARY 1981 $2.00

Personal Computing

FOR YOUR HOME AND BUSINESS

A CLOSE-UP LOOK AT DATA BASE MANAGEMENT PROGRAMS

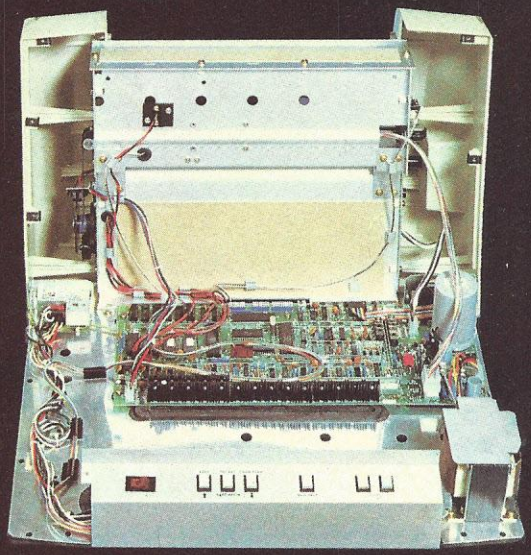


A hands-on report on the TRS-80 color computer

Computerized comparison shopping for life insurance

A menu-writing program for your Apple

Say Ahh...



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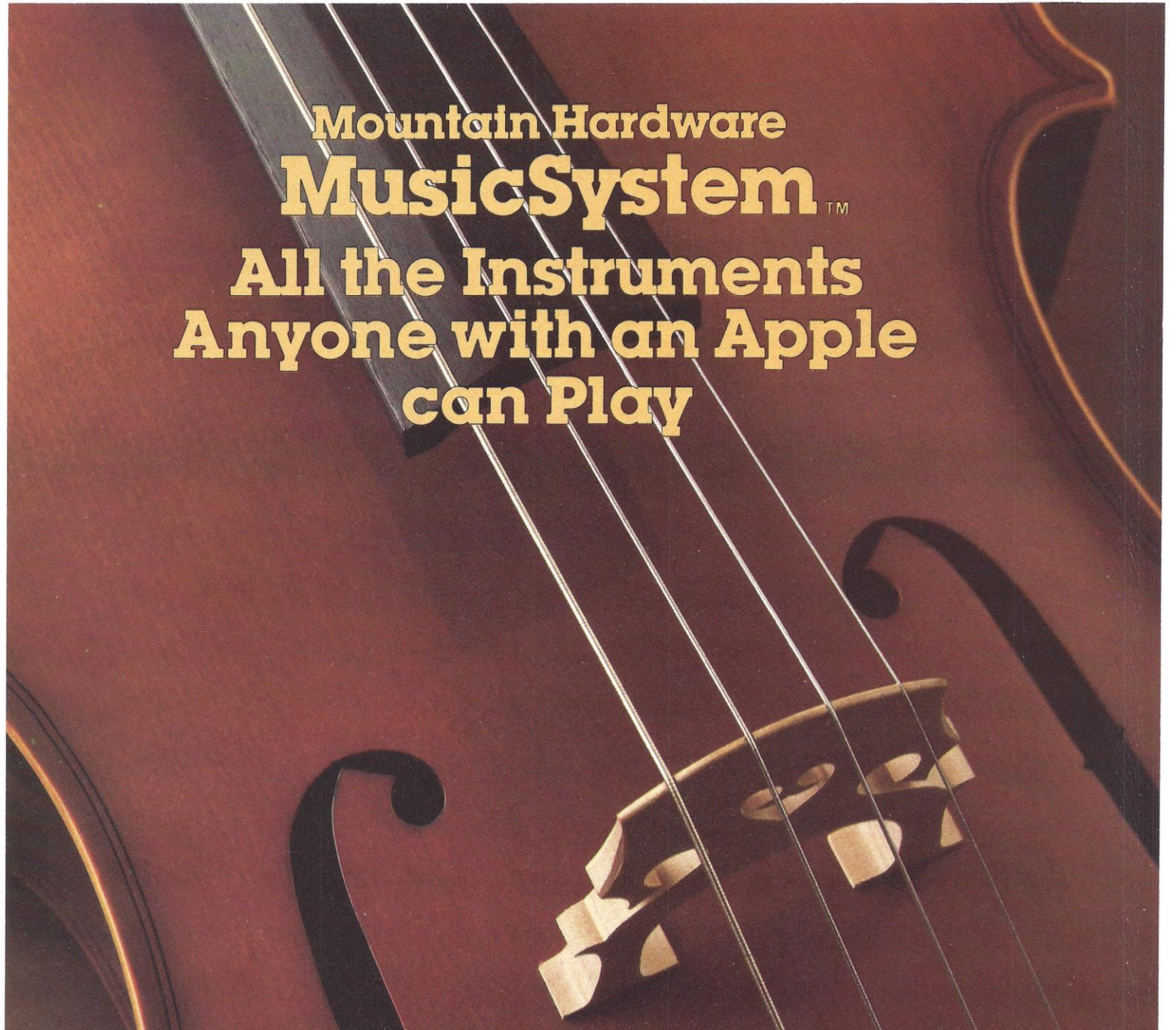

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Personal Computing

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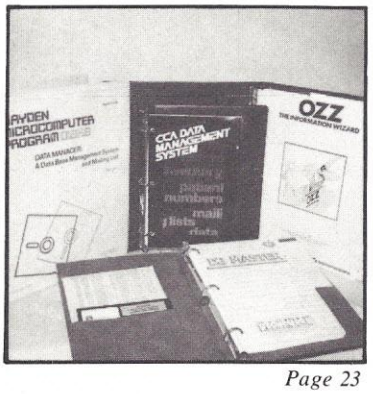

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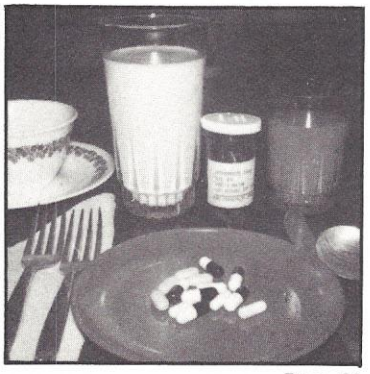

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How to Choose Data Base Management Programs 23
One of the most useful applications of personal computers is in managing information, or data bases. But choosing a program to handle the task isn't easy. This article will point out the things you should know before buying a data base management program. *by Fred Blechman and Jules H. Gilder*

Fractional Arithmetic 32
A general purpose program for performing mathematical operations with fractions. *by Dr. Marlene Milkent*

Program Index for TRS-80 Mini-Disk 36
Instead of remembering the program titles on your diskettes, you can use this program to display the disk directory and then run any of the programs with a single key entry. *by C.A. de Zoysa*

Menu-Writer 38
Avoid re-writing menus for each of your programs by using this handy utility. *by Kenneth Miles*

Life Insurance Analysis 44
Here's a program for comparing and analyzing life insurance policies offered by different insurers, as well as different policies offered by the same insurer. *by Edwin K. Hunter*

Where Does It All Go? 51
Learn how to formulate a budget and then use a "what if" approach to balance it. This program keeps a spending history in order to allow for realistic planning for successive budgets over a period of months. *by Ray Vukcevich*

TRS-80 Color Computer 57
This in-depth review looks at Radio Shack's entry into the field of color microcomputers. *by Ralph Burris*

How to Afford That Dream House 62
This program helps you analyze available assets you can use during the purchase of your dream house. *by William Lappen*

Drug and Food Incompatibilities 64
Interactions between drugs and food can have a profound effect on your health. This program accepts a drug's name, searches your data and outputs a classification of the drug together with a list of foods to avoid. *by Rinaldo Prisco*

Simulation: Is it for you? 73
Using a computer to create a model of a problem situation allows you to examine a wide range of alternatives in relation to the problem. This article explains the basics of computer simulation and outlines the steps used in developing a simulation. *by Charles J. Wilson*

DOS Commands in TRS-80 Level II BASIC 76
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Archimedes' Spiral 81
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Estimating Construction Material Costs 83
Home handypersons will find this program a quick means of estimating materials usage and cost for common home remodeling jobs. *by David D. Busch*

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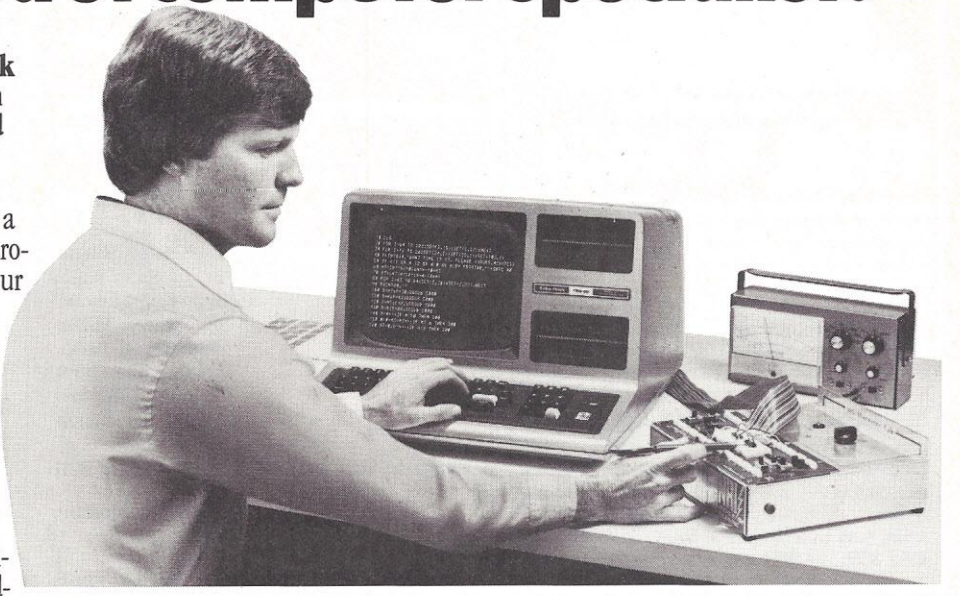

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CIRCLE 2

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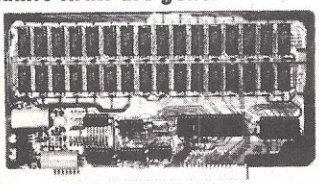

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CIRCLE 8

Personal Computing

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Modular Software Associates $24.95 ($26.45 CA)

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'Tiny' Pascal runs on any 16K Level II system, includes the programming structuring capabilities of full Pascal, but not data structuring.

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Tape 3, People's Pascal $19.95

Tape 1, 34 buis., edu., game progs. $10.95
Tape 2, 77 programs from Osborne book: Some Common Basic Programs $10.95
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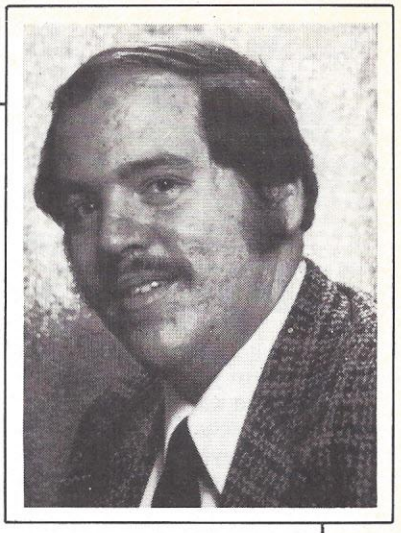
CIRCLE 9

EDITORIAL



WANTED: A Few Good Articles

Personal Computing is always looking for interesting and well-written articles. To help you target your articles for specific issues, and to give you an idea of what kinds of articles will be published in the coming months, I am reproducing a part of our 1981 Editorial Scheduling Guide here. In addition to the software articles we have traditionally presented, we are also interested in simple hardware projects that our readers can build. Ideally, the project should be easy to build in one or two evenings.

March
Printer Roundup
Speech I/O Devices
Review of Inventory Programs

April
Disk Memories: Floppies and Hard Disks
Printer Interfaces
Overvew of Commercially Available Assemblers

May (NCC Issue)
Microcomputer Roundup
Special Report on Computer Languages
Microcomputer Operating Systems
Compilers vs. Interpreters

June
EPROM Programmers
Semiconductor Memories
Financial Modeling Systems

July
Computer Music Systems
Payroll Program Roundup
Special Report on Computer Games Software

August
Video Displays and CRT Terminals
General Ledger Program Roundup
Special Report on Educational Software

September
Modems
Communication Software Packages
Accounts Receivable Software Roundup

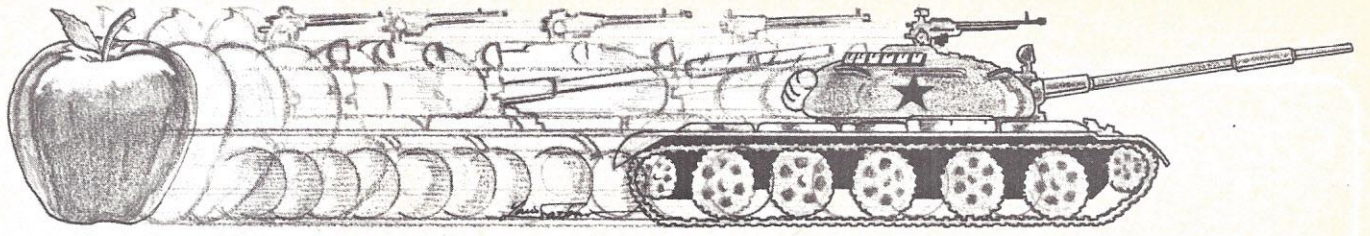
October
Single Board Computer Systems
Special Report on Utility and Diagnostic Software
Accounts Payable Software Roundup

November
Special Report on S-100 Computer Systems
Special Report on Software for Science Engineering

December
Special Report on Networks
AC Controllers for Microcomputers
Tax Preparation Software Roundup

To encourage some of you who have not contributed yet, we have increased the fee paid for articles to between $40 and $75 per printed page—so let's hear from you.

Jules H. Gilder
Editor



HOW TO TURN AN APPLE INTO A TANK.

With **Computer Conflict**™ and a little imagination, we'll transform your staid and respectable Apple computer into the fearsome war machine of the Soviet Red Army. Computer Conflict actually consists of two fast-paced, action-packed wargames played on full-color mapboards of Hi-Res graphics: **Rebel Force** and **Red Attack!**

REBEL FORCE puts you in the role of a Soviet commander whose regiment must face a computer-directed guerrilla uprising which has overrun a vital town. Armed with your tank, heavy-weapons, and infantry units, your mission is to regain the town through the annihilation of the Rebel Force.

Your advance will be brutally opposed by minefields, ambushes, militia, and anti-tank guns — all skillfully deployed by your computer. Survival and success of your units will depend on your ability to take advantage of the variable terrains - open, forest, and rough - each of which has different movement costs and shelter values.

In this finely-balanced solitaire wargame, every move is played under real-time conditions: Procrastinate and lose. At the same time, caution cannot be cast aside; severe unit losses will only result in a Pyhrric victory at best.

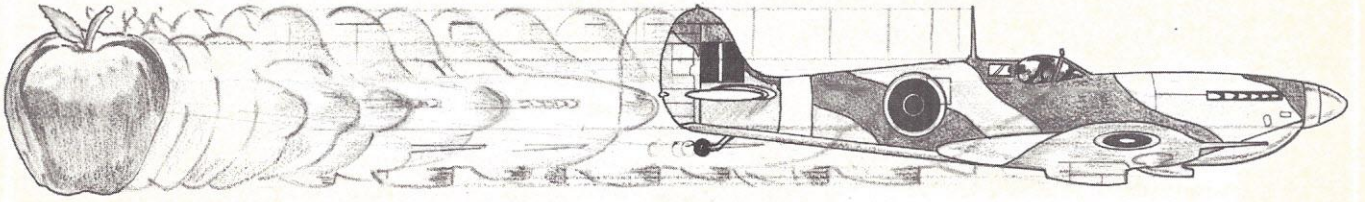
With its five levels of difficulty (plus one where you make up your own), the computer can and will stress your tactical skills to their fullest.

RED ATTACK! simulates an invasion by a mixed Soviet tank and infantry force against a defending battalion. As the defender, your task is to deploy your infantry units effectively to protect three crucial towns — towns that must not fall!

As the Russian aggressor, your objective is to crush the resistance by taking two of these three towns with your tanks and infantry. With control of these strongpoints, the enemy's capitulation is assured.

Red Attack! is a two-player computer simulation of modern warfare that adds a nice touch: At the start of each game, the computer displays a random setup of terrains and units, providing every game with a new, challenging twist.

Computer Conflict, for $39.95, comes with the game program mini-disc and a rule book.



OR A SPITFIRE.

After you're done playing Computer Conflict, you may be in a mood for something other than ground-attack wargames. In that case, **Computer Air Combat**™ is just what you need.

With Computer Air Combat, your screen lights up with an open sky generated by Hi-Res graphics offering global and tactical plots. Squint your eyes a bit, let loose your mind, and you'd swear your keyboard has melted into the throttle, rudder, altimeter, and other cockpit instrumentation of a World War II combat plane. In fact, any of 36 famous fighters or bombers, from a Spitfire and B-17 Flying Fortress to the Focke-Wulf 190 and A6M5 Zero. Each plane is rated - in strict historical accuracy and detail - for firepower, speed, maneuverability, damage-tolerance, and climbing and diving ability.

Practically every factor involved in flying these magnificent airplanes has been taken into account, even down (or up?) to the blinding sun. Climb, dive, twist, and turn. Anything a real plane can do, you can do. However, the computer prevents all "illegal" moves - such as making an outside loop (which in real life, would disastrously stall a plane).

PLAY THE COMPUTER. Aside from being the game's perfect administrator and referee, the computer will serve as a fierce opponent in the solitaire scenarios provided: Dogfight, Bomber Formation, radar-controlled Nightfighter, and V-1 Intercept. There's even an Introductory Familiarization Flight (with Air Race option) to help you get off the ground.

With the number and type of planes and pilot ability variable, you can make the computer as challenging as you want to give you the ultimate flying experience.

PLAY A HUMAN. Two can play this game as well, in dogfights and bomber attacks. Given a handicap of more or better planes or an ace pilot (or all of the above), even a novice at Computer Air Combat stands a chance to defeat a battle-hardened veteran.

For $59.95, Computer Air Combat gives you the game disc, a rule book, two mapboard charts (for plotting strategies between moves), and three player-aid charts.

Credit card holders, if you own an Apple®II 48K (Applesoft ROM) and a mini-floppy disc drive, call **800-227-1617 ext. 335 (toll free)** and charge your order to your VISA or MASTERCHARGE. In California, call 800-772-3545, ext. 335.

To order by mail, send your check to: Strategic Simulations Inc, Dept. CC, 465 Fairchild Drive, No. 108, Mountain View, CA 94043. All our games carry a 14-day money back guarantee to assure your satisfaction.

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  Computer Bismarck, TRS-80 32K Cassette: $49.95
- ☐ **Computer Ambush** (a tactical simulation of man-to-man combat in WWII) for your apple: $59.95
- ☐ **Computer Napoleonics**, the Battle of Waterloo for your Apple: $59.95
- ☐ **Computer Quarterback** (a real-time strategy football game): $39.95

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CIRCLE 3

FEEDBACK

TI 99/4 Comments

Dear Editor:

I would like to thank Mr. Harley Templeton and *PC* for the excellent article, "Translating TRS-80 Level II BASIC to TI 99/4 BASIC," published in the November 1980 issue.

As a user of the relatively new TI 99/4, I have been frustrated by the lack of available software. This article will greatly simplify the conversion of programs from the vast pool of material written in TRS-80 Level II BASIC.

The recently formed T.I. Houston Users Group is interested in hearing from people with a desire to join or exchange programs. If interested contact:

Raymond R. Wells
T.I. HUG
8922 Roos Rd.
Houston, TX 77036

A Faster Return on Investment

Gentlemen:

Thank you for publishing "Return on Investment Made Simple," by William A. Carr in the September issue. This is a program that my firm has needed for some time. Mr. Carr is to be congratulated.

After installation of the program on our TRS-80 we tested the program using the sample data included in the article. As we processed we became aware of the long processing time due to the step-by-step iteration of the calculation. We modified the program and are quite pleased with the improvement in run time. We will probably modify it further to prevent a continuous loop if the return on investment is less than 2% or greater than 30%.

Modified listing:

```
280  K=1400
281  K=3000
282  K=200

430  IF K < >1400 THEN 490

560  IF S < 0 THEN 565
561  KI=(K+KH)/2
562  KL=K
563  K=KI
564  GO TO 290
565  KI=(K+KL)/2
566  KH=K
567  K=KI
568  GO TO 290
```

Thank you and Mr. Carr for making this program available.

William C. Lishawa, CPA
Forest, OH.

Modem-Less Communications

Dear Editors:

I'd like to make a call for serious TRS-80 users who wish to experiment in phone communications.

A pair of us have developed working programs which use slowed baud rate software to send BASIC or machine language programs without conventional Bell 103 type modems. We are interested in seeing how far apart the system will work and would be willing to supply software listings and details of the simple phone amplifier (a modified Radio-Shack or Heathkit phone patch) to anyone interested in joining our "network."

A 32K disk system is required. If you're really interested in following through, enclose a SASE for initial details. This is not a commercial endeavor; we simply would like to gather a few interested users to test our developments and exchange ideas.

The phone connection can be by acoustic coupling (R-S amplifier) and avoids legal complications.

R. K. Fink
4011 Starlight Circle
Dayton, OH 45415

Pet Merging Mistakes

Dear Editor:

I used the merging for the Pet program found in your July 1980 magazine. It does everything but erase the merging program. I have tried to debug it but have been unsuccessful.

Perhaps an article on how to use the PEEK/POKE features would be beneficial to us beginners. Even better would be an article on how to rewrite TRS-80 programs for the Pet; there are some nice programs that are hard to adapt because of different commands.

Sharon A. Fasenmyer
Altoona, PA

Author's note: The problem is in line 63012. Instead of POKE 622,9 it should read POKE 158,9. Instead of POKE 158 + x,13 it should read POKE 622 + x,13.
— *Ronald L. Servoss, M.D.*

Depreciation Schedules Updated

Dear Sir:

I enjoy reading your magazine every month and feel I have learned a great deal about computers and programming by doing so.

In the December issue, Mr. W. B. Goldsmith presented a well-written and informative article on Depreciation Schedules written for the SWTP 8K Basic Computer. I am enclosing another version of this program written for the TRS-80, Level II. Although not as elaborate as Mr. Goldsmith's program (there is no provision for printed output and only one item at a time can be calculated), my program performs essentially the same functions. The user enters the depreciable basis of the item (i.e. the price after subtracting the salvage value and/or any other necessary deductions) and then selects the type of depreciation to be calculated. The screen will be then fill (ten years at a time) with the depreciation history of the item for the number of years which the user has entered for the Useful Life of the article.

I hope this program, like Mr. Goldsmith's, will be of use to your readers.

Daniel Miller
Astoria, Queens
New York, New York

(continued from page 7)

```
10 REM * STRAIGHT LINE DEPRECIATION *
20 REM ** DECLINING BALANCE DEPRECIATION **
30 REM *** SUM OF THE YEARS' DIGITS DEPRECIATION ***
40 REM **************************************************
50 REM * DANIEL MILLER *
60 REM * 2815 34 ST. ASTORIA, NEW YORK   11103 *
70 REM **************************************************
80 GOSUB1030 :'DIRECTIONS
90 CLS:RESTORE
100 M$="$$###,###.##"
110 PRINT"ADJUSTED BASIS OF PROPERTY:
(COST +/- ADJUSTMENTS - SALVAGE VALUE, IF NEEDED) = $ ";:INPUT B:IF B<=0 THEN110 ELSE PRINT
120 INPUT"USEFUL LIFE OF PROPERTY (IN YEARS) = "iL:IF L<1 THEN120 ELSE PRINT
130 W=L
140 INPUT"NO. OF MONTHS IN SERVICE (FIRST YEAR) "iM:PRINT
150 IF M<1 OR M>12 THEN140
160 PRINT:PRINT"WHICH TYPE OF DEPRECIATION:":PRINT"(1) STRAIGHT LINE":PRINT"(2) DECLINING BALANCE":PRINT"(3) SUM OF THE YEARS' DIGIT
S",:INPUT E
170 IF (E<1)OR(E>3) THEN160
180 PRINT:IF E=2 PRINT"WHICH RATE OF DECLINING BALANCE:":PRINT"(1) 1.25":PRINT"(2) 1.50":PRINT"(3) 2.00",:INPUT V:IF (V<1)OR(V>3) TH
EN180ELSE FOR C=1TOV:READ D:NEXT C
190 DATA 1.25,1.50,2
200 CLS
210 ON E GOTO220 ,240,260:'FOR ITEM USED ALL 12 MONTHS FIRST YEAR
220 PRINT"STRAIGHT LINE:"
230 GOTO270
240 PRINT"DECLINING BALANCE:"
250 GOTO270
260 PRINT"SUM OF THE YEARS' DIGITS:"
270 PRINT
280 GOSUB1010
290 Y=0
300 Z=1
310 IF M<12 GOTO600 :'IF ITEM USED LESS THAN 12 MONTHS DURING  THE FIRST YEAR
320 D1=B/L
330 H=B/(L*(L+1)/2)
340 Y=Y+1
350 ON E GOTO360 ,430,510
360 REM * STRAIGHT LINE METHOD *
370 B=B-D1
380 PRINTY,
390 PRINTUSING M$;D1,:PRINT" ",:PRINTUSING M$;B
400 Z=Z+1:IF Z=11 INPUT"PRESS =ENTER= TO CONTINUE ";A$:CLS:IF Y=N THEN420  ELSE GOSUB 1010:Z=1
410 IF Y<L THEN340
420 GOTO1340
430 REM ** DECLINING BALANCE **
440 D4=B*(D/L)
450 B=B-D4
460 PRINTY,
470 PRINTUSING M$;D4,:PRINT" ",:PRINTUSING M$;B
480 Z=Z+1:IF Z=11 INPUT"PRESS =ENTER= TO CONTINUE ";A$:CLS:IF Y=N THEN500  ELSE GOSUB 1010:Z=1
490 IF Y<L THEN340
500 GOTO1340
510 REM *** SUM OF THE YEARS' DIGITS ***
520 G=L-Y+1
530 D6=G*H
540 B=B-D6
550 PRINTY,
560 PRINTUSING M$;D6,:PRINT" ",:PRINTUSING M$;B
570 Z=Z+1:IF Z=11 INPUT"PRESS =ENTER= TO CONTINUE ";A$:CLS:IF Y=L THEN590  ELSE GOSUB 1010:Z=1
580 IF Y<L THEN340
590 GOTO1340
600 ON E GOTO610,710 ,810 :'IF ITEM USED LESS THAN 12 MONTHS DURING THE FIRST YEAR
610 Z=1:'STRAIGHT LINE METHOD
620 D2=(B/L)*(M/12)
630 Y=Y+1
640 B=B-D2
650 PRINTY,
660 PRINTUSING M$;D2,:PRINT" ",:PRINTUSING M$;B
670 D1=D2*(12/M)
680 Z=Z+1
690 GOTO340
700 END
710 Z=1:'DECLINING BALANCE METHOD
720 D5=((D/L)*B)*(M/12)
730 Y=Y+1
740 B=B-D5
750 PRINTY,
760 PRINTUSING M$;D5,:PRINT" ",:PRINTUSING M$;B
770 D4=D5*(12/M)
780 Z=Z+1
790 GOTO340
800 END
810 Z=1:'SUM OF THE YEAR'S DIGITS METHOD, PART OF FIRST YEAR
820 G=(L*(L+1)/2)
830 H=(B/G)
840 Y=Y+1
850 G=L-Y+1
860 D7=(G*H)*(M/12)
865 B1=B
870 B=B-D7
880 PRINTY,
890 PRINTUSING M$;D7,:PRINT" ",:PRINTUSING M$;B
900 REM - SECOND AND SUBSEQUENT YEARS
910 Z=Z+1
920 Y=Y+1
930 D9=(B1*(W/G)*((12-M)/12))+(B1*((W-1)/G)*(M/12))
940 B=B-D9
950 PRINTY,
960 PRINTUSING M$;D9,:PRINT" ",:PRINTUSING M$;B
970 IF Z=10 INPUT"PRESS =ENTER= TO CONTINUE ";A$:CLS:IF Y=L THEN1000   ELSE GOSUB 1010:Z=1
980 W=W-1
990 IF Y<L THEN910
1000 GOTO1340
1010 PRINT"END OF YEAR","DEPRECIATION","PRESENT VALUE":PRINT:RETURN
1020 END
1030 CLS:PRINTTAB(24)"DEPRECIATION":PRINT:'DIRECTIONS
1040 PRINT"     IF YOU OWN YOUR OWN SMALL BUSINESS, THIS PROGRAM WILL"
1050 PRINT"HELP YOU COMPLETE FORM 1040, SCHEDULE C-2 'PROFIT (OR LOSS)
1060 PRINT"FROM BUSINESS OR PROFESSION'.":PRINT
1070 PRINT"     THE PROGRAM CALCULATES DEPRECIATION BY THE THREE"
1080 PRINT"FOLLOWING PROCEDURES:":PRINT
1090 PRINTTAB(15)"(1) STRAIGHT LINE ;":PRINTTAB(15)"(2) DECLINING BALANCE (125%, 150%, 200%) ;":PRINTTAB(15)"(3) SUM OF THE YEARS' D
IGITS ."
1100 PRINT:INPUT"PRESS =ENTER= TO CONTINUE ";A$:CLS
1110 PRINT"     BEFORE BEGINNING, DETERMINE THE ADJUSTED BASIS (YOUR"
1120 PRINT"ACTUAL COST) FOR THE ITEM.  THE ADJUSTED BASIS IS THE TOTAL"
1130 PRINT"OF YOUR PURCHASE PRICE, MONEY BORROWED AND THE FAIR MARKET"
1140 PRINT"VALUE OF SERVICES OR PROPERTY YOU PROVIDED.":PRINT
1150 PRINT"     CERTAIN ADJUSTMENTS, E.G. TRANSPORATATION AND"
1160 PRINT"INSTALLATION COSTS, AND OUTLAYS FOR CAPITAL IMPROVEMENTS"
1170 PRINT"WILL RAISE THE ADJUSTED BASIS; OTHERS, E.G. DEPLETION"
1180 PRINT"ALLOWANCES AND CASUALTY LOSSES, WILL LOWER THE BASIS."
1190 PRINT:PRINT"     (FOR A COMPLETE DESCRIPTION OF BASIS AND DEPRECIATION"
1200 PRINT"OBTAIN I.R.S. PUBLICATION 17, 'YOUR FEDERAL INCOME TAX',)
1210 PRINT:INPUT"PRESS =ENTER= TO CONTINUE ";A$:CLS
1220 PRINT"     FINALLY, IF YOU USE EITHER THE STRAIGHT LINE OR SUM"
1230 PRINT"OF THE YEARS' DIGITS METHOD, SUBTRACT FROM THE BASIS THE"
1240 PRINT"SALVAGE VALUE, I.E. THE AMOUNT YOU BELIEVE YOU COULD GET"
1250 PRINT"AT THE END OF THE ITEM'S USEFUL LIFE.  THIS FIGURE, THE"
1260 PRINT"ADJUSTED BASIS, WILL BE USED IN THE PROGRAM.":PRINT
1270 PRINT"     DO NOT DEPRECIATE THE ITEM PAST ITS SALVAGE VALUE.":PRINT
1280 PRINT"     AN ITEM PUT INTO SERVICE BY THE FIFTEENTH OF THE MONTH"
1290 PRINT"IS CONSIDERED IN USE FOR THE ENTIRE MONTH OTHERWISE IT IS"
1300 PRINT"NOT CONSIDERED FOR DEPRECIATION UNTIL THE FOLLOWING MONTH."
1310 PRINT"IF AN ITEM HAS BEEN USED FOR THE ENTIRE FIRST YEAR, ENTER '12';"
1320 PRINT"IF NOT, ENTER THE APPROPRIATE NUMBER OF MONTHS.":PRINT
1330 INPUT"PRESS =ENTER= TO BEGIN ";A$:CLS:RETURN
1340 PRINT:PRINT"ARE THERE ANY MORE ITEMS TO DEPRECIATE (Y/N) ?"
1350 Q$=INKEY$:IF Q$="" THEN1350 ELSE IF Q$="N" THEN PRINT:END ELSE IF Q$="Y" THEN CLS:RESTORE:GOTO110 ELSE1350
```

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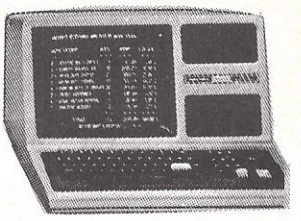

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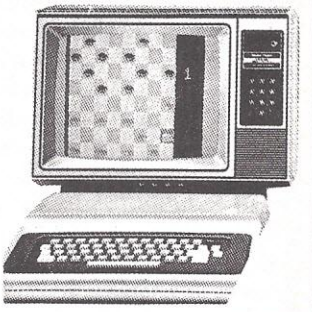

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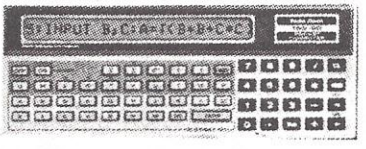

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CIRCLE 11

RANDOM ACCESS

Preschoolers Look Forward to Computerized World

Today's preschoolers will be living their adult years in a mostly computerized world, according to a Michigan State University professor of electrical engineering and systems science.

"Public acceptance is the major issue," said P. David Fisher, who has been doing research on microcomputers for eight years. "Almost anything technological is possible now, provided that people agree to switch from their preference for the familiar to something useful but unfamiliar."

The preschoolers' acceptance of a computerized world, to which they are already introduced, may come easier than it did for older generations who used to talk of "pulling the plug" on computers.

Today's grandparents and great-grandparents have come a long way, Fisher sympathized, from inventions of crystal radios, Model-T Fords with 7-mile-an-hour speed limits and gravel roads before arriving at today's developments in communication satellites, computer-monitored auto engines and space flights.

"In supermarkets," Fisher said, "people used to make a din about stores' attempts to eliminate unit pricing. Now they casually watch sales clerks at the checkout stands wave purchased items over computer-recording devices."

A sampling of the start-to-finish kind of computerized living which is either current or possible, Fisher said, is found in the farming, harvesting, distribution, processing, vending and purchasing of foodstuffs.

"It is now possible, with computers," he said, "to precisely schedule plowing, planting, fertilizing, spraying, irrigating, treating with pesticides, and harvesting of food crops, according to climate, soil, weather and elevation.

"Distributing, storing, processing and delivering of stocks to markets and stores can be computer-aided. Consumers in markets and stores can or will be able to make purchases from vending machines and conveyor belts according to their preferences in sizes, weights, brands and prices.

"At checkout, consumers can get a paper tally of their purchase, complete the purchase by having the clerk contact their bank to arrange payment (without any handling of bills and coins) and the bank can report on ability to cover the purchase," he said.

Elsewhere in daily life, Fisher foresees extended electronic use in police records, medical records and school records.

In industrial employment, there can be computer aid in time keeping, payroll, inventory, production, assembly, testing, as well as in heating and cooling of buildings and disposal of wastes.

In banks and offices, word processing and recordkeeping already is far advanced.

Workers still will be needed for "remedial" employment to monitor and fix computer systems which break down. Workers will continue to program computers to do previously manual work and other desired electronic functions.

Homes, said Fisher, probably will have electronic systems to meet changing needs of heating, cooking and hot water supplies.

New cars, Fisher noted, already are computerized to adjust to prevailing engine conditions, altitudes and temperatures.

"What comes next," said Fisher, "depends largely on the public acceptance of technology's growing potential."

St. Benedict's Farm, a monastic community in Waelder, TX, uses a microcomputer to handle information on their cows and calves.

"We invested in a microcomputer, not only to keep books and mailing lists," said community leader, George Gannon, "but to keep performance records on our purebred Beefmaster operation." Since no such program existed, Gannon wrote one and called it Beefup.

The Beefup system regularly provides two major reports: Cowprint and Cafprint. John Kelly, herd manager explained, "Cafprint compares weaning and yearling weights of calves by year and sex, and provides a Sire Summary to help in bull evaluation. Cowprint gives you all the significant performance information in the lifetime of every cow in the herd (and each of her calves), and makes it available to you at the office or in the field in seconds. Even for large herds, you don't need a briefcase or a filing cabinet. Just a clipboard."

Typed inputs — mostly dates, weights, ear tag numbers — stored on a computer disk, are the raw data. From this base, calculations are made and printed out on command. Mrs. Whiggins (as they affectionately call their "automatic secretary") keeps the reports constantly updated so they can tell how old any given cow in the herd is, and whether she's due for calving, weaning, breeding, or pregnancy checking. Packed in neat readable rows are

data on every calf she's had, including such tiny bits and pieces as calving interval, times bred, days open, number of calves, actual and adjusted weaning weights, calf ratings and comments.

"The computer is a magnificent management tool, but only a tool," Gannon said. "Computers can't think. They can't breed cattle or make business decisions. People do that. But Beefup does afford ranchers an astonshing wealth of vital herd information right at their fingertips."

When neighbors got interested in Beefup, Gannon adapted the program for other ranching situations (up to 999 cows), and wrote a how-to manual. "To use our program," Gannon noted, "the computer must run a CP/M operating system with 48K RAM. You also need the CBASIC language package. For ranchers who don't own their own computer we offer a Beefup computer service. Subscribers send us the data, we enter it on our own computer, and send them back the reports."

St. Benedict's Farm is a small monastic community of laymen now in its 25th year. While their monastic life is based on the ancient 6th century Rule of St. Benedict, their mode of pursuing a livelihood is altogether modern, mechanized, and nowadays, even computerized.

"In designing the Beefup system," says Gannon, "we decided from the beginning it had to be easy, simple and practical. Easy on the manager and ranch hands with a minimum of figures to be jotted down in the field; simple for the computer operator with 'human engineering' built-in to make the program work for you instead of presenting you with an obstacle course; and above all, practical for the business management of the cattle enterprise rather than trying with an avalanche of confusing numbers to turn the operation into an experiment station. Beefup provides facts — all the relevant production data and calculations, but it does not dispense with the man in management. The computer brings a whole new dimension to the breeding and business management of cattle.

Market Accelerates for Educational Microcomputers

From 1980 to 1985, the combined retail value of microcomputer shipments to educational institutions will well exceed $1 billion, according to an analysis of the educational market for microcomputers released by Creative Strategies International (CSI), a California-based market research and consulting firm.

The educational microcomputer industry, as defined in this study, encompasses fully-configured microcomputer systems priced under $15,000 and marketed to educational institutions in the United States. Through direct mail and interview surveys, CSI has documented the diversity of applications in the educational microcomputer market, including instruction in computer programming, computer fundamentals, computer-assisted instruction (CAI), educational administration and research. Even with substantial sales into educational environments, present market saturation remains low.

CSI expects the continued rise of retail prices for fully-configured systems through 1982 due to the increasing use of peripherals and educational software. Unit prices will fall slowly for the balance of the forecast period, as component prices continue to decline. Currently, peripheral sales are rising more rapidly than software or system sales because of the growing use of floppy disks and printers. By 1985, one-half of all microcomputers destined for educational settings will use floppy disks.

Microcomputer technology presently competes against several other technologies in the educational market, including traditional educational tools, time-sharing systems, and mini- and large-scale computer systems. Recognition of the mistakes and faults of these competing technologies will be crucial to the success of microcomputers in educational settings.

Supply of adequate software has historically been poor, and expecially in the predominant classroom segment, success will hinge on the ability of the vendor to provide extensive, high-quality educational software. With accelerating market growth, and the emerging trend of educational users toward the purchase of many systems at a time, the educational software market continues to attract many new microcomputer firms. The intensified concentration on educational applications software will undoubtedly have profound effects on the educational microcomputer industry.

While complementing the teacher and the textbook, the microcomputer will to some extent replace them in the classroom. This, coupled with the opportunities of a new market, continues to draw educational publishers into educational software development and marketing. Their entrance into this market will significantly impact the industry — stimulating further software development and subsequent further sales, and providing the impetus toward even more widespread educational microcomputer usage.

While new firms are continuing to enter the market at a rapid rate, providing microcomputers, computer peripherals, and software, the markets for the lowest-

priced microcomputers are currently dominated by Apple, Commodore and Radio Shack. However, they are under direct attack by firms like Atari.

Creative Strategies International's new Industry Report, *Microcomputers in Education,* provides an analysis and forecast of issues and trends for microcomputers at all educational levels: elementary, intermediate, high school, college and university, trade school and others. Market segments analyzed include classroom, educational administration and research. The study traces the evolution of microcomputer firms active in this market and examines competing and complementary products.

Microcomputers in Education, which sells for US $1195.00, is based upon results of surveys to educational institutions, microcomputer manufacturers, and software producers. In addition, all major microcomputer manufacturers active in the educational market were interviewed. This information was combined with demographic data to forecast the educational market for microcomputers through 1985.

For more information contact Creative Strategies International, 4340 Stevens Creek Blvd., Suite 275, San Jose, CA 95129.

CompuServe Offers Food Information from Home Service Magazine

Food information from *Better Homes and Gardens* magazine is a new offering of the CompuServe information service, according to CompuServe Incorporated and Meredith Corporation. Electronic delivery of the information to CompuServe's more than 4,000 subscribers across the country began late last year.

Better Homes and Gardens, a home service magazine for families, is published by Meredith and has a circulation of 8 million.

Information related to the magazine's monthly recipe features will be offered with detailed nutritional and calorie analyses. Other features being planned are complete menus built around a recipe, approximate food costs per serving and recipes in addition to those which appear in the magazine.

At a later date, the service will be expanded to cover other areas, such as gardening, building, decorating, crafts, travel and money management information as it appears in the magazine.

Subscribers to the CompuServe information service will have access to some of the "raw" material used by the magazine's editors.

Information from *Better Homes and Gardens* will be another service available at no additional charge beyond the $5 per connect hour rate to the CompuServe information service.

Personal computer users across the country are currently using the CompuServe information service which includes features such as news from major regional newspapers and international news services, electronic mail and bulletin board service; educational and financial programs; the MicroQuote securities information system; a computer software exchange; several programming languages and various computer games.

Manufacture of 8-Bit Microprocessors Would Aid Micro Suppliers

Manufacturers of microcomputers for small business and personal computing applications would benefit from further development of 8-bit microprocessors, according to Dr. Robert Harp, chairman of Vector Graphic Inc.

The dramatic proliferation of microcomputers has been characterized by the development of thousands of assembly language programs for 8-bit units, according to Harp. "The magnitude of this growth is extraordinary even in the computer industry which has been noted for explosive expansion. It is one of the truly significant phenomena of our time and has already begun to have an effect on daily life. What promises to make the microcomputer boom even more significant than past computer developments is the contribution to software development made by thousands of individuals. The implementation of microprocessors with completely different instruction sets, such as 16-bit units, creates major headaches for companies with large investments in proprietary software such as word processing, BASIC interpreters and operating systems," Harp says.

"To begin manufacturing 16-bit microcomputers for small business and personal computing would make it necessary either to abandon an incredibly rich software resource, or to obviate the 16-bit performance advantages by accommodating 8-bit software through translators and emulators."

Harp concedes that semiconductor companies are compelled

to push technology ahead and to create circuits of growing complexity, such as the 16-bit microprocessors. This is necessary for competitive and economic reasons. Semiconductor companies must create new components that offer improved profit margins to amortize the growing capital investment costs associated with state-of-the-art integrated circuits.

"Microprocessor chip manufacturers may seek to recover the front-end development cost of the new components through the sale of expensive development systems and software. These firms have long promoted the use of high level compilers such as PL/M. This approach suffers from the fact that the code generated by such a compiler may occupy twice the memory space and execute with half the speed of an identical program in assembly language. This performance penalty effectively cancels the advances in going from 8-bit to 16-bit processors," Harp argues.

Nevertheless, he anticipates that there is a signficant market for any company that would concentrate on 8-bit microprocessors and memory components, providing more dense circuitry and faster operating speeds with the 8080 or Z-80 instruction set. "Silicon-on-sapphire processes hold the promise of increasing speed by a factor of 2 to 4. This would be an enormous benefit to microcomputer manufacturers who could then provide systems that operate at speeds approaching the performance level of minicomputers," Harp says.

Faster microcomputer processing speeds are important, for example, to the use of higher level interpreted languages and for large data base handling. "A doubling of processing speed would also mean that several input/output terminals could operate with a single central processing unit and still maintain acceptable performance. While 16-bit microprocessors could achieve the same thing, it would be at the cost of rewriting existing software, thus pulling the rug out from under hundreds of manufacturers enthusaistically producing systems with 8-bit processors."

Among the companies capable of implementing silicon-on-sapphire technology, Harp mentions Rockwell International, Hewlett-Packard and Intel. Companies such as these would endear themselves to small business and personal computer manufacturers and would also benefit from immediate access to a segment of the military market, according to Harp. Silicon-on-sapphire processes are inherently resistant to radiation damage, a capability that is required in military systems.

"At first glance, it appears that the step from 8-bit microprocessors to 16-bit is not much different from the evolution from one generation of computers, such as the IBM System 360 to another, such as the IBM System 370. Today there are still a great many programs running on 370 systems, through software emulators, that were originally developed for the very early IBM 1401 computers. Business has learned to live with the performance penalty that this implies. But, I question whether the performance advantages of 16-bit microprocessors will find rapid acceptance in light of the set-back dealt to a large number of young computer manufacturers who do not have the resources to cope with the change."

Harp emphasizes that Vector will be a participant in the 16-bit microcomputer market when it develops. "We have designs underway that use 16-bit microprocessors and, when a suitable market is available, Vector products will be there. But we feel that for the near future at least our customers would benefit more from improvements in the performance of 8-bit systems."

Microprocessor manufacturers are providing some speedup versions of 8-bit chips. As an example, Harp points to new versions of the Z80 microprocessor that operate at a speed of 6-megahertz vs. the 2.5- megahertz speed of the original. Selected Z80 microprocessors can even achieve speeds of 8 megahertz. This has been largely accomplished by shrinking the chips in size. The shrinking is, in turn, made possible by improved photolithographic equipment and improvements in the processing.

These enhancements of the original 8-bit chips are, however, reaching a practical limit, Harp points out. Further significant performance improvements would certainly require new processes such as silicon-on-sapphire, or design changes that increase speed without changing the instruction set, such as the unconditional "prefetch" of instructions implemented in the Intel 8086 processor.

National Career Network Computerizes Job Market

A national multiple listing of job opportunities and resumes compiled through select recruiting firms coast to coast has been computerized by Computer Search International of Baltimore, Maryland and placed on The Source.

The CSI "Career Network" is supported by a membership of executive recruiting firms in major metropolitan centers throughout the United States and in England and Australia. Descriptions of corporate job opportunities and individual resumes are listed within the program for all Source users. Individuals and corporations can quickly sort through the job market data with reference to salary range, geographic location, job experience, education, special skills, and a practically unlimited keyword selection of specifications. This sorting process allows facile organization of thousands of job opportunities or resumes in any of 40 job categories, display-

ing the several that apply perfectly to any applicant or corporation.

All information listed on the Career Network is confidential. Resumes and job openings are key-coded to the CSI Career Network member recruiting firm that holds the listing. Follow-ups are made directly to the member firm or directly to Computer Search International at 1500 Sulgrave Avenue, Baltimore, Maryland 21209.

"The job market is extremely mobile," explained CSI founders. "Twenty percent of all employed people are constantly on the move for greater job specialization, salary reward, and geographic improvement. They are dependent upon newspaper advertisements, executive recruiting firms, and chance information to find a better job. The time normally spent searching for a job is enormous. Now, at home on a computer terminal they can find that job easily right away, and corporations can make their needs known just as easily."

"We are proud to have the CSI Career Network online with our many other databases," Source president Marshall Graham said. "The Career Network has been planned for 17 months. Through this service and the electronic mail facility on Source, executive recruitment firms, corporations, and people constantly on the move will save an enormous amount of time getting together."

★★★ Announcements ★★★

Executive Computer Conference

The Executive Computer Conference will be held April 13-14 in Washington, DC. This two-day meeting, which has as its theme "Improving Organizational Productivity through Systems Technology," will focus on key aspects of the computer's contribution to organizational productivity from a senior management perspective.

Trends in the use of computer technology to make planning, paperwork and personnel management more productive will be discussed. For further information, contact the conference chairman, Kendall Burroughs, The Executive Computer Conference, 1730 North Lynn St., Suite 400, Arlington, VA 22209; (703) 521-6209.

Educational Courseware

Educational Solutions, an educational research and development organization in New York City directed by Dr. Caleb Gattegno, recently received a grant from the National Science Foundation for the development of microcomputer courseware for teaching numeration, addition and subtraction. This approach to mathematics is based on learning through insight and practice rather than learning through memorization and drill, said the company.

Learners are engaged in activities based on perception. The activities enable the student to control operations which parallel the set of mental operations required by numeration, addition and subtraction. Feedback helps guide and refine the student's growing insight; practice transforms this insight into functional skills.

Under the provisions of the grant, Educational Solutions will first produce the courseware in prototype form and then test it with learners of various ages in public schools. After the results of the field testing are analyzed, the courseware will be revised and prepared for distribution.

For more information contact Educational Solutions Inc., 80 Fifth Ave., New York, NY 10011; (212) 924-1744.

A I Conference

Artificial intelligence will be examined in a week-long conference to be held at the University of British Columbia in Vancouver, Canada, August 24-28.

Conference topics will include medical diagnosis by computer, person/machine interaction, computer aided design, memory models, knowledge representation, speech understanding, psychological modeling, three-dimensional representation and processing.

Inquiries regarding the one-day tutorial program or the week-long R&D exhibit program should be made to: Louis G. Robinson, American Association for Artificial Intelligence, Stanford University, Box 3036, Stanford, CA 94305; (415) 495-8825.

Educational Software Project

Ohio State University's College of Education has begun a project to develop and disseminate exemplary curricular materials in which high technology is used to teach basic mathematical skills including problem solving, estimation and computer literacy.

Funded by the U.S. Department of Education, the project will collect and evaluate existing educational software for microcomputers (Apple, TRS-80, Pet and so forth) and select high quality units for inclusion. Other curricular elements will be developed by the project under the direction of Suzanne Damarin, Marlin Languis and Richard Shumway. The curricula will be field tested and disseminated nationally. Individuals or groups who have developed programs related to

mathematics at the upper elementary school level are invited to submit them for possible inclusion for national dissemination. To have materials considered, send a cassette tape or floppy disk together with a printout, machine documentation and any related information to Dr. Suzanne K. Damarin, TABS Project, Arps Hall 202-A, 1945 N. High St., Columbus, OH 43210. For further information write or call Dr. Damarin at (614) 422-1257.

Radio Shack Store

Radio Shack announced the opening of its 4,000th company-owned retail store. The new store brings the total number of Radio Shack outlets, worldwide, to over 7,800.

Tandy Corporation, of which Radio Shack is the principal operating division, reported sales for the first quarter of its 1981 fiscal year, ended September 30, were $334,865,000, an increase of 15% over the year earlier sales of $290,969,000.

Net income per share rose 33% to $1.01 from $0.76 for the same period last year. Net income for the quarter ended September 30, 1980 was $25,763,000, a 34% increase over the net income of $19,294,000 reported in the first quarter of fiscal 1980.

Pocket Computer Newsletter

The Pocket Computer Newsletter reports on news and product reviews concerning pocket and hand held computers, such as the recently announced Radio Shack TRS-80 Pocket Computer. Published 10 times per year, the newsletter also carries such features as programming tips, operating timesavers, tutorial articles, notes on customizing units, programming short cuts, listings of practical programs, technical information and application forums. The 10-issue subscription price is $20 in the U.S., $24 in Canada, $30 elsewhere. A sample issue is $2. For more information contact: The Pocket Computer Newsletter, PO Box 232, Seymour, CT 06483.

Call for Papers

The Fifth Western Educational Computing Conference will be held in San Francisco on November 19 and 20 under the sponsorship of the California Educational Computing Consortium.

This is a call for papers dealing with computers and computer applications in any area that might be of interest to instructors and administrative personnel dealing with computers at the college or university level.

Original papers with two copies should be sent no later than March 1, 1981, to Professor Alpert at the address below. They should be typed, double-spaced, and approximately 1500 words in length. The title page of each paper must contain the author's name, complete mailing address, and telephone number. A brief abstract should precede the text.

Contributors will be notified of the acceptance of their papers by May 1, 1981. Accepted papers will need to be retyped by the author in a form suitable for reproduction. Special forms for such retyping will be supplied to authors at the time of notification of acceptance. Retyped papers must be returned by August 1, 1981.

Mail entries to Professor Elizabeth Alpert, Computer Science Department, Hartnell College, 156 Homestead Ave., Salinas, CA 93901.

CourseWare Magazine

Each issue of CourseWare Magazine, designed and documented for educational use, will be offered in three versions: Apple II, Pet, and TRS-80 Level II. Machine-readable programs will be supplied on a cassette tape so they may be used right away by teachers and their students, or parents and their children.

Each issue of the magazine will contain two programs selected from the pre-college curriculum areas of Business, Consumer Economics, English, Fine Arts, Foreign Language, Industrial Arts, Mathematics, Physical Education, Science, and Social Studies, or from the area of teacher-assistance programs. Each student program in the magazine will be accompanied by a complete teacher's guide, a student's guide, worksheets (if applicable), suggestions on how to adapt programs for individual classroom lessons, a description of variables used in the program, and a full listing of the program. Teacher programs (computer managed instruction, computer supported instruction) will be accompanied by a user guide.

For information contact Dan Isaacson, School of Business, California State University, Fresno, CA 93740; (209) 487-2792.

Atlanta Show

Producers of small computers, peripheral equipment, supplies, and services will be on hand to demonstrate products at the Atlanta Small Computer Show, June 6 to 9, at the Atlanta Hilton.

Show promotion is designed to attract small and medium-sized business owners, corporate and government executives, and data processing, engineering, and purchasing managers, as well as other potential small computer users such as doctors, lawyers, accountants, and other professionals. The broad range of computers which can be used by the individual will also be featured.

Additional information can be obtained by writing The Atlanta Small Computer Show, 4060 Janice Dr., Suite C-1, East Point, GA 30344; (404) 767-9798.

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CIRCLE 12

DCA Meeting

The Digital Computer Association (DCA) annual 1981 meeting will be held on March 20 at the Pacifica Hotel, 6161 Centinela Blvd., Culver City, CA. Cocktails are at 5:30 p.m., dinner at 7:00, program at 8:00. Send reservations and payment to Mary Rich, 731 Bayonne St., El Segundo, CA 90245.

Search for Help for the Handicapped

A nationwide search for ideas and inventions to aid the handicapped through computer technology will be announced by The Johns Hopkins University on November 25.

A highlight of the search will be a contest for the best submissions by professionals, students and amateurs. A $10,000 grand prize and 100 other national and regional awards have been established.

The national search is supported by grants from the National Science Foundation, and Radio Shack, a division of the Tandy Corporation.

For more information contact Cyril J. O'Brien, 953-7100 Ext. 3743; Paul M. Hazan, 953-7100, Ext. 449.

West Coast Computer Faire

The 6th West Coast Computer Faire will be held in San Francisco April 3 to 5. 20,000 to 24,000 attendees from all over the world are expected. Last year's faire drew 20,000. Entire tour groups are being organized to attend the 6th Computer Faire from England and Japan.

The trade and consumer exposition includes over 400 exhibits by most of the manufacturers and distributors of low-cost systems for small-business, school and home.

The conference program will include 50-120 speakers, who will provide tutorials for the novice, and state-of-the-art presentations for experts. Topics range from computers in education, electronic prosthesis for the physically impaired, computer art, exotic games, information utilities, legal aspects of computing and biomedical applications.

Registration is $10. Reduced-fee pre-registration will be available from Computer Faire, 345 Swett Road, Woodside, CA 94062; (415) 851-7075.

Dental Computer Newsletter

The DCN is an international group of dentists, physicians and office management people who have interests in office computers. Though the emphasis is on microcomputers, many members use minis.

DCN offers members a monthly newsletter, software exchange, advice and experience, and access to members in your area.

Annual membership dues are $12. Membership runs from January to January. If you join mid-year, the group supplies you with the year's back issues. For more information contact Dental Computer Newsletter, E.J. Neiburger, editor, 1000 North Ave., Waukegan, IL 60085; (312) 244-0292.

ACM Conference Call for Papers

The program committee of the 1981 ACM Annual Conference, November 9 to 11, in Los Angeles is soliciting tutorials, proposals for panel discussions, and short technical papers or surveys.

The range of suggested topics includes operating, database, and distributed systems; programming languages; artificial intelligence; business data processing, software engineering; project management; personal computing; office automation; privacy and security; computer architecture; graphics networks, computer law; computers in education, medicine, aerospace, the military, and the entertainment industry; computers and society; computers and the handicapped; and simulation.

Authors of papers or surveys should submit four copies of their work, typed and double-spaced, not exceeding twelve pages in length. Proposals for special sessions or tutorials should contain sufficient details to explain the presentation. The deadline for submission is March 7. Authors will be notified of acceptance or rejections by May 1. All submissions should be mailed to: ACM '81 — Call for Papers, Village Station, P.O. Box 24059, Los Angeles, CA 90024.

Further information on the program is available from Steven Abraham, Xerox Corporation A1-46, 702 S. Aviation Blvd., El Segundo CA 90245; (213) 536-7167. Emily P. Friedman, Computer Science Dept., UCLA, 3732 Boelter Hall, Los Angeles, CA 90024; (213) 825-6835. 825-1322 (msg).

Computer Game Festival

The fourth annual PACS Computer Games Festival sponsored by the Philadelphia Area Computer Society and LaSalle College Physics Department will be held on March 14 from 10 A.M. to 5 P.M. in the LaSalle College Ballroom located at 20th and Olney Philadelphia, PA 19141.

For further information contact Stephen A. Longo, Ph.D. Physics Department, LaSalle College, Philadelphia, PA 19141; (215) 951-1255.

RANDOM ACCESS

Users Group Formed

The formation of a new microcomputer users' group, the Microcomputers in Planning Association, has been announced by Executive Director Robert L. Stockman. The group's purpose will be to act as a clearing house for information on microcomputer hardware and software as they might apply to the field of physical and social planning. Special emphasis will be placed upon disseminating information on applications of microcomputer technology for use by public agencies, the academic community, and commercial ventures as well.

Individuals who might be interested in membership, or who have need of more information about the group are invited to write to: Mr. Robert L. Stockman, Executive Director, Microcomputers in Planing Association, 1204 People's Building, 60 Monroe, Grand Rapids, MI 49503. Dues are $10 per year, which includes a subscription to their bi-monthly newsletter.

PRODUX 2000

Facing off at center ice in New York's Madison Square Garden on March 11th through the 13th will be the two shows composing PRODUX 2000. The "Business & Personal Computer Sales Expo '81" will play host to manufacturers of mini and microcomputer systems and peripherals, and the "New York Business Show" will cover word processing systems, business communication systems, business-oriented graphic systems, and other related products. The show hours will be 11 a.m. to 7 p.m. each day, and the individual admission charge at the door will be $6.00. An interesting side note is that, unlike similar shows, there will be equipment for sale at the show proper, so bring your checkbook.

Computer Industry Exposition Site Set

CITE, the Computer Industry Trade Expo will be held June 24th through the 26th in Atlantic City, New Jersey's Convention Hall. The expo is being held in the hope of introducing manufacturers of computer systems, related products and services to distributors, dealers, OEMs, third-party resale organizations, integrators and systems houses. There will be a seminar series scheduled around the exhibition hours as well. There will be no fee charged to those who register in advance, and those appearing at the door without preregistration or a manufacturers' invitation will be assessed a nominal entrance fee. For more information and registration information, contact the show office at 110 Charlotte Place, Englewood Cliffs, NJ 07632. Telephone (201) 569-8542. See you on the boardwalk.

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We've taken artistic license with our illustration in order to make a point: MYCHESS is the most powerful microcomputer chess program on the market, bar none.

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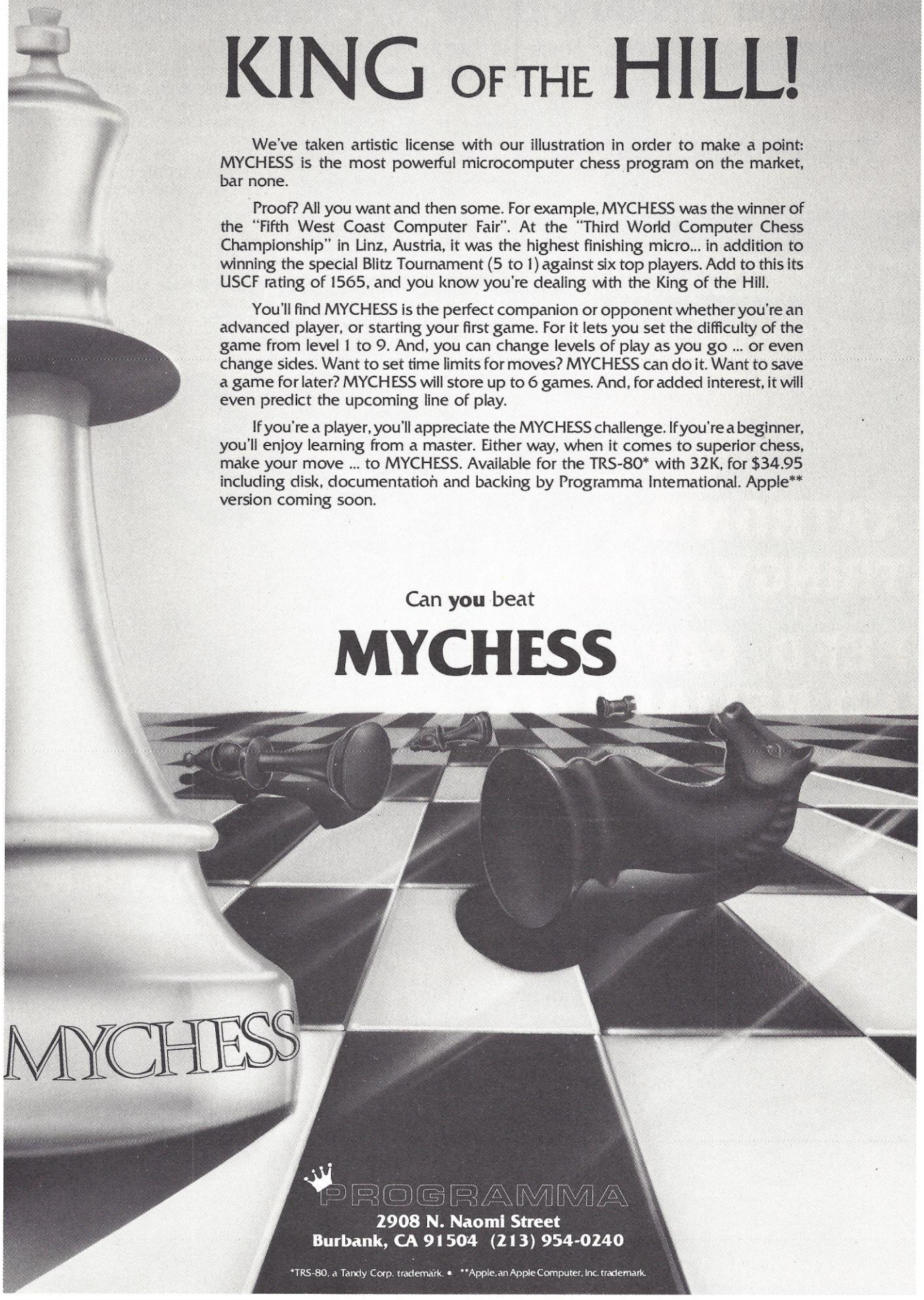

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CIRCLE 4

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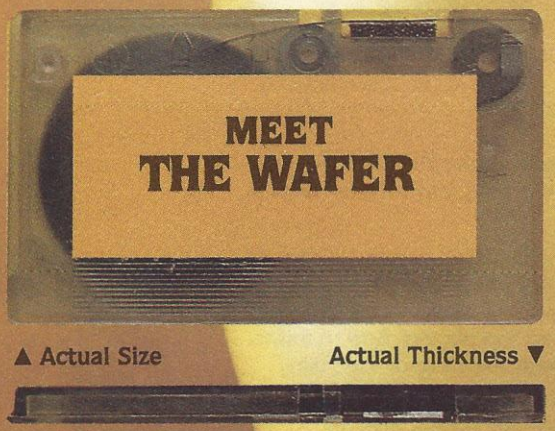

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SYSTEM COST (First unit plus interface)	$60	$250	$800
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How To Choose Data Base Management Programs

BY FRED BLECHMAN AND JULES H. GILDER

Managing the large amounts of information that people come in contact with every day both in personal and business situations, is becoming an increasingly difficult task. To the owners of personal computers, this task can be simplified by using a data base management (DBM) program.

Choosing a data base program is not an easy task. Which system is right for you? How can you find it? What price should you pay for a data base program? Is it really a data base program? Do you need a real data base program? Can you modify it? Is it protected from copying? If so, are backup copies available? How much do they cost? What happens if the disk fails to operate through no fault of yours? Are modifications and updates available?

In addition to these basic questions, which should be answered before any purchase is made, it is also important to know what the maximum capacity of the program is. How many records can it handle? How many fields can there be in each record? How many characters can be in each field? How many characters can there be in each field label? Does it accommodate multiple screens? Does the program have a sort capability? What kind? Is it written in BASIC or machine language?

It is essential that all of these questions be answered and that you understand how to interpret the answers so that you can make an informed decision on which program to buy. Even before these questions are tackled, however, it is important that you understand what data base management programs really are.

What are data base management programs?

There are probably as many different definitions for data base management programs as there are programmers who write them. Putting it in simple terms, a data base management program is one that is used to produce and keep track of an organized collection of records that are related by a common format used to store the information.

Data base management programs allow you to easily enter and manipulate data in a variety of ways. For example, consider a mailing list of 200 customers used by a small business. By appropriately coding the information entered, it's possible to generate mailing labels for all customers; for those who have not ordered something within a specified period of time; for those who only purchase certain items, or only for those with certain zip codes. With some programs, it is even possible to calculate mathematical relations between numerical data, get an inventory report or even generate form letters.

The basic features required in data base management programs include capabilities for the creation, storage, editing, manipulation and preparation of reports based on one or more files, where each file contains a group of records with similar information that is organized in a manner unique to that particular file.

The number of different types of data bases used by the average person is incredible. A list of names and addresses used for sending out New Year's cards or wedding invitations is a data base; so it a list of the daily or weekly appointments of a doctor or dentist. An important data base used every day by millions of persons is the telephone directory; another is the classified ad section of the local newspaper.

Every one of these data bases can be converted for use on a computer with a data base management program, and they'd all be easier and faster to use. In fact, this is already being done. Mailing list programs are popping up in computing magazines (see PC, Nov. 1980, pg. 46) as are appointment scheduling programs (see PC, Nov. 1980, pg. 70). Although no one has yet entered an entire telephone book into the memory of a personal computer, the Bell System uses a large computer and a data base system to help answer the calls it gets for information every day.

Understanding the language

To get a better idea of what data base programs are and how to select them wisely, you have to understand data base terms. The best way to understand the various terms used is to go back to the predecessor of the computerized data base—the filing cabinet. By looking

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Mr. Blechman is an avid computer and electronics hobbyist and has written over 160 magazine articles.

at the illustration, it is clear that there are several levels of complexity in filing systems just as there are in data base systems.

In data base systems, the smallest piece of useful information is the individual *character*. In most filing systems, this is true only if information is stored in a sequential manner, alphabetically for example.

The next highest level in a data base system is a *field*. In a manual filing system, a field corresponds to the headings or titles given to the data that are entered. For example, in a mailing list application, one field might be labelled NAME, while another might be labelled ADDRESS. Each field contains a group of characters.

When there are a lot of fields of information on a specific subject, the fields may be arranged into one or more *pages*. All of the pages taken together represent a *form*. Just as in a manual system where you frequently enter information by filling in a standard form, the same is true of data base management programs where a form can be displayed on a video display to prompt you for information. A filled in form is called a *record*.

When records using the same form are combined and stored together, they are called a *file*. In a manual system, a file is generally represented by a manila folder that contains the various forms.

In a manual filing system, the highest level of complexity is the filing cabinet itself. In a data base system, the cabinet is represented by a personal computer's storage medium which is generally a floppy diskette or cassette tape.

How do you choose?

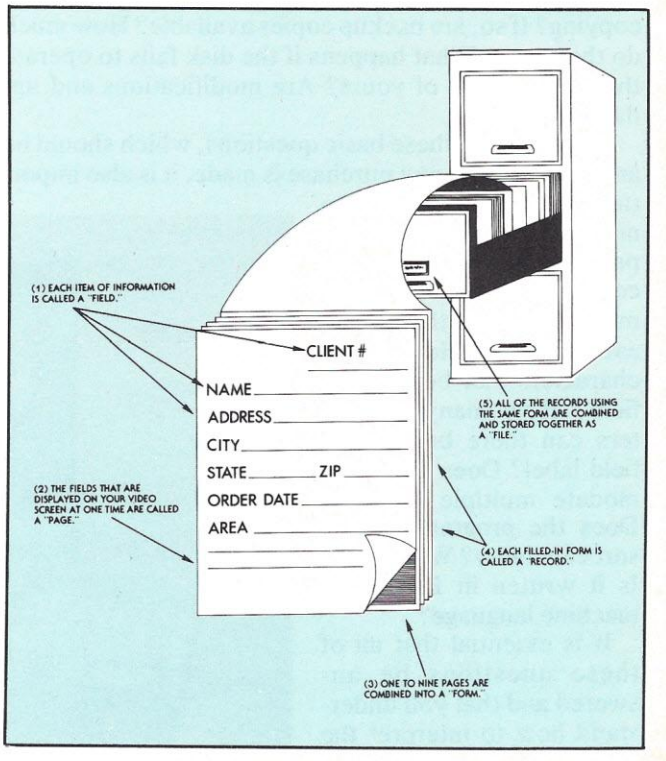
When considering the purchase of a data base program, you first have to decide what you want it to do. If you are going to be using the program for a single application such as a mailing list or inventory system, your best bet may be to buy a specialized program designed for that specific application. A specialized program will probably have extra features that you will find handy in your application. In an inventory application, for example, it's desirable to be able to sum up numerical fields so that the total number or value of the items inventoried can be determined. Most commercially available data base programs do not have this capability but specialized programs for this task almost always do.

If it is necessary to set up a versatile system that can be customized for a variety of different tasks, or if there is no specialized program for your application, then you must use a data base program that you can modify. If you elect to use such a program, you must then decide whether a structured or an unstructured type of data base is required. The decision usually depends upon the intended application.

In an unstructured data base such as *Whatsit*? or *Versa-File*, information is entered as a sentence and is stored using key words from the sentence. This type of system is easy to use, even by someone with no computer background, and is fine for use as an electronic notepad or reminder because it is easy to retrieve information from it. However, the lack of an ability to sort records, the unwieldy input of information and the limited or sometimes nonexistant ability to print reports, make unstructured data bases undesirable for most business applications.

Prices for disk-oriented systems vary from $49.95 for Hayden's *DATA MANAGER* to $395 for Commodore's *OZZ*. Program characteristics vary almost as widely. Some programs are entirely resident in RAM (random access memory) while others are broken down into individual modules that are loaded as needed. It is usually desirable to have the entire program in RAM at one time, as this speeds up program operation. When a modular approach is used, you always have to wait for the modules to be loaded from the disk. Loading can take from 10 seconds to almost a minute and can get to be annoying after a while.

The one case where it's desirable to have a modular program is when a system is RAM-based rather than disk-based. In a RAM-based system, all information (the data base) is resident in RAM; this has both advantages and disadvantages. On the plus side, it is possible to search and find any record or other piece of information almost instantaneously as there is no need to turn a disk drive on, wait for the disk head to position itself correctly and then read the data off the disk into RAM.



Like a manual filing system, data base management programs break information that is to be stored into smaller units such as records and fields.

The big drawback of a RAM-based system is that the total size of the data base is limited to the amount of available RAM in the computer, minus whatever is necessary for the program and its overhead.

For data bases that are larger than available RAM, it is necessary to break the data down into two smaller files than can be loaded separately. Searching for data can then become awkward because most RAM-based systems do not have the ability to search multiple files, even if the files are on the same disk.Such searches must normally be done manually by loading and searching each file separately.

Another big disadvantage of RAM-based data base systems is that unless you save your data file to disk frequently, you risk losing all of your newly-entered

data if there is a power failure. The moment that power is removed from a RAM, all data stored there are lost.

One factor that determines whether a RAM- or disk-based system is used is the storage medium. If tape is used for storage, chances are good that the system will be RAM-based, because most tape systems are not interactive. More importantly, data stored on tape are only available serially. If the information you're interested in is at the end of the file, you must wait until all the information preceding it has been read. Because most tape-based DBM programs are excruciatingly slow, most practical applications for data base systems are implemented on disk systems.

Disk storage techniques vary

In disk-based DBM programs, data are stored and retrieved in a variety of ways. Looking through the manuals, one finds strange acronyms such as ISAM, KSAM and KRAM, to name just a few.

ISAM is an acronym for Indexed Sequential Access Method. With this technique, records are stored on the disk in alphanumeric order. To do this, the computer has to know which field or combination of fields to look at to determine the alphanumerical order. In some systems, such as Stoneware's *DB Master*, you can specify the field(s) to use; in other systems such as Commodore's *OZZ*, the system requires that the first alphanumeric be the one used to index the record. By the way, these special fields are often referred to as *key* fields.

In operation, you enter the key for the record you desire. The computer determines the first letter of the key and does an alphabetic search to see if the key is listed on its directory. If the key is not listed, the computer generates an error message. If the key is listed, the computer retrieves a record pointer that is associated with the key and uses the pointer to find the desired record. For instance, the key leads to a record whose pointer is number seven, the computer starts at the beginning of the data file, counts six records and then reads the seventh.

KSAM stands for Keyed Sequential Access Method. The only difference between this method of storage and ISAM is that the keys are not stored on the disk alphabetically, and, as a result, it can take slightly longer to find the correct key and its associated pointer.

KRAM stands for Keyed Random Access Method. This technique is similar to KSAM except that with KRAM, it isn't necessary to start at the beginning of data and count until the relative record number is reached. Instead of getting information that indicates the record we want is the seventh record, KRAM tells the computer the absolute location of the data so that the machine can go directly to it.

The last of the acronyms frequently encountered is SAM, which you can probably deduce stands for Sequential Access Method. SAM is the slowest of the methods and requires that the computer starts at the beginning of the data and reads each record until it finds the one it wants. This is the technique used by the TRS-80 version of the *CCA Data Management System* from Personal Software.

When considering the purchase of a DBM program, it is wise to find out if the program is written in machine language or in BASIC. Answering the question "Which is better?" is difficult because it all depends on what you need.

Machine language is fast

Machine language has a big advantage in being fast. Speed is particularly important when doing searches and even more valuable when doing sorts. Machine language speed is generally not important when you enter information from the keyboard, but is nice when outputting information to the video screen because the data seem to pop up instantaneously.

A big drawback of machine language DBMs is that they are difficult or even impossible to modify for your own needs. The problem is compounded by the fact that few programmers are disciplined enough to write a program in a well-organized way. If source listings of the machine code are not available, (and they generally aren't) it's almost impossible to figure out what's going on.

Lack of organization can also be a problem with a DBM programs written in BASIC, but even with a poorly organized BASIC program, it's fairly simple to figure out what is going on so that you can modify the program to suit your needs.

What sort of program is it?

As mentioned earlier, the biggest drawback of using BASIC for a data base program is that BASIC sorts are much slower than those in machine language. (The difference in speed could be as much as 100 times.) The language used, however, is not the only factor that determines sorting speed; sorting technique is just as important. In fact, it's conceivable that a poorly-implemented machine language sort could be slower than a well-designed BASIC sort.

When investigating a DBM program, you should always find out what type of sort the program uses. If it is a "bubble" sort, beware, because the "bubble" sort is one of the slowest types available even when implemented in machine language. One of the fastest sorts is the Shell-Metzner sort. Other fast sorts are known as Quicksort and Heapsort. Sorting techniques represent a field unto themselves and won't be covered in depth here. Just remember that you should shy away from bubble sorts and can expect reasonable results with any of the three fast sorts mentioned above.

The best solution to the machine language-versus-BASIC problem is combining the languages to use machine language for time-consuming searches and sorts and BASIC for most everything else. Using both languages gives you flexibility in modifying the program should you find it necessary, and yet you don't have to sacrifice the speed advantage of machine language programs. Synergistic Software does a good job of marrying BASIC and machine language in just this way in a program called, *The Modifiable Database* for the Apple II computer. As the name implies, it is simple for you to modify this program in any way you see fit.

How much can it store?

It's important to know how much information a data base program can store before you buy it. Unfortunately, not enough people pay attention to storage capacity until it's too late. It is very important to know how to

estimate your storage needs. This means that you have to sit down and plan exactly the information you will store and how much space you will allow to each field in the record. Always give yourself a little extra room.

Once you determine the number of characters (or bytes) you require for each entry or record, check to make sure that the program you're interested in can accommodate your needs. Most programs allow 255 bytes or less per record. Very few allow for more, although *DB Master* permits records of up to 1020 bytes.

Once you determine that the program's record size parameters are acceptable, you're still not out of the woods. You must make sure that the lengths of the various fields are also acceptable. Although most DBM programs let you define field length any way you wish, some programs will put a maximum length restriction on the fields. Make sure you can live with the parameters before you buy.

Label it, if you can

If you determine that field and record lengths are compatible with your needs, you can breathe a little easier. You should now check for limitations on the length of labels that you will use to identify the fields. Some programs (like the *DATA MANAGER* program) have no limitation because they don't pemit labels at all. Others allow you to have field labels of limited length, such as IJG's *Radex 10,* which limits field labels with a length of 12 characters, and *OZZ,* which is limited to 16 characters. The presence or absence of labelled fields is not critical, although it does help to make a system easier to use.

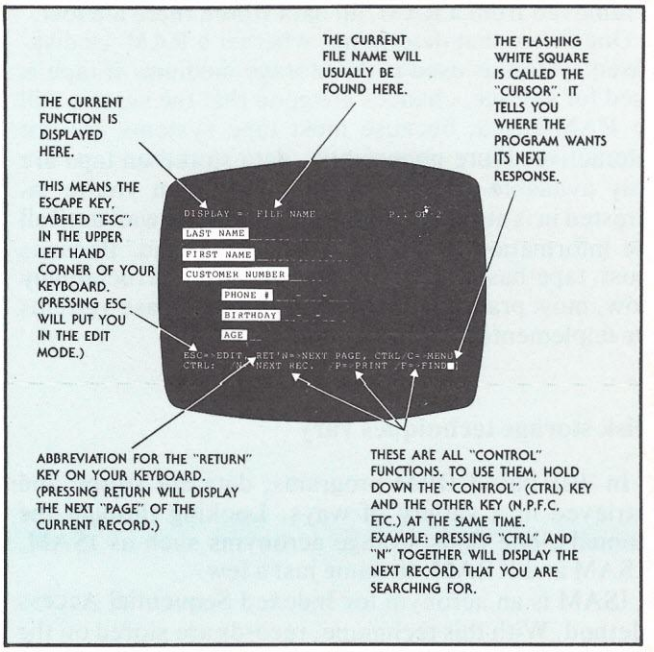
Customizing the program

The nice thing about *true* data base programs is that they can be easily customized by a user who has absolutely no knowledge of computer programming. Two approaches are generally taken in modifiable programs: either the program interviews you to determine what characteristics the final program should have, or you are permitted to produce your own formatted screen.

The first approach is somewhat limiting in that you have no control over what the screen format will look like. The user is asked the number of fields required, their labels, the type of information and length of each field. *Modifiable Database* exemplifies this type of approach. The interesting point about this approach is that after you are interviewed, the computer goes about creating a complete, stand-alone customized data base program. The creating program determines screen format.

The second approach to program customization is to let you operate a screen editor, which allows you to set up the screen exactly the way it is to appear when in use. This feature is becoming available in an increasing number of data base programs including *DB Master, JINSAM Data Manager* and *OZZ.* With this technique, you simply fill in a form, which for convenience can contain multiple items on a single line. If a lot of data are to be entered, a form may consist of several pages.

DB Master, for example, allows the user to set up a program with as many as nine pages. Not all programs



Formatted screens such as this one produced by DB Master, prompt the user to enter the required information.

allow multiple pages; most are limited to one or two. Some simply scroll information off the top of the video screen.

Getting help when you need it

The real test of a good program (be it a data base program or any other kind) is whether it has a HELP feature. On a well-designed program, pressing the Escape key, or typing HELP or just H, should invoke a subroutine that helps you to progress. User aid may take the form of a list of all the commands available and a short description of each, or may be descriptive text. If a program doesn't have a HELP feature, you should ask yourself what other features the programmer was too lazy to include.

Of course, getting help is not limited to help provided by the program. If instructions aren't clear on a particular point, or if your application results in the discovery of a bug, or if you need help interfacing the program to a non-standard peripheral, (or if it just doesn't work) you may have to contact the software publisher for additional information. Make sure help will be available before you buy a program. Try to contact a firm by phone a few times, at different hours of the day, and ask questions. If company personnel can't or won't answer your questions, look somewhere else.

Here's what's available

There are two major unstructured data base programs — *Whatsit?* and *Versa-File*. *Whatsit?,* a program that first came out for CP/M systems, and later for the Apple II, is produced by Computer Headware and sells for $125. This BASIC program, a self-indexing data base manager, stores information and cross-references it to any tag. Information and/ or cross reference tags can be added and deleted at any time, and information can be accessed or changed in many ways. To change information, you simply type in the new data. The program responds by telling you what the former in-

formation was and asks if you wish to change it. The program is capable of holding between 1500 and 3000 items of data. Data are entered as short sentences that consist of a subject, tag and object. Each of the three constructs is limited to a maximum of 30 characters.

An excellent feature of *Whatsit?* allows you to retrieve data even if you don't remember the exact spelling by using the SOUND'S command. All you do is type an item exactly the way it sounds. For example: SOUND'S KAR could retrieve an entry such as Nancy Carr. The biggest drawback of the program is that it can't generate a printed report.

Radio Shack's *Versa-File* is similar to *Whatsit?*, but isn't quite as sophisticated. It isn't as expensive either. The TRS-80 Model I program costs $29.95 and the Model II version sells for $69. Information is entered as English sentences, but there is no limit on the construction of the sentences as there is in *Whatsit?*. The only requirement is that an entry ends with a period. To retrieve information, you enter a keyword from the original sentence and the program returns the original sentence plus any other sentence that contains the same word. Versa-File, written in BASIC, is unprotected. The program can produce printed output. Minimum system configuration is a 16K Model I with one disk drive.

Bridging the gap between structured and unstructured data base management programs is *DATA MANAGER: A Data Base Management System and Mailing List* from Hayden Book Co. This $49.95 program, for the Apple II computer, is written in machine language and comes with two accessory programs and a sample data base (of Scientific American articles) on the disk. Record length is limited to a maximum of 256 characters. The number of fields and their lengths are variable as long as the total record size isn't exceeded. Fields are defined by a carriage return. If only one 256 character field is used, *DATA MANAGER* can be utilized in much the same way as *Versa-File*.

One of the strong points of *DATA MANAGER* is a powerful screen editor that allows the insertion and deletion of characters, words and lines. In addition, the program features a delete buffer which stores the last 256 characters deleted, in case you change your mind and want to restore them. Scrolling can be up or down one line at a time, or 12 lines at a time, and allows you to jump to the beginning or end of your file quickly. The edit mode also features a string search option which makes it easy to locate records that have to be updated. Other edit mode features automatically count the number of records currently on file and let you know how much memory is available.

DATA MANAGER, a RAM-based DBM program, is limited to a maximum file size of 32K characters in a 48K Apple computer, while this could be a limitation, it is also an advantage because the limitation results in an average access time to any record of one-half second.

The biggest drawback of the program is that it doesn't let you format the screen or use field labels that would simplify data entry.

Another machine language program, called *CONVERTER*, is also included on the program disk. When the program is run, you can create a subfile from an already existing file. Thus, if you have a mailing list and want to create a file that contains only the names of those people who live in New York, you can. The last program included on the disk is a BASIC program that prints out mailing labels three-across instead of the one-across format provided in the main program. By examining this program and its comments, you can design your own printout format.

A self-writing program

Slightly higher in price at $79.50, is the *Modifiable Database* from Synergistic Software. This BASIC/machine language hybrid is an interesting program to behold. In operation, it interviews you to determine your system configuration and whether a printer is available. The Apple II program then asks questions about the data base to be created, including the number of fields and their lengths. At the end of the interview, the program directs the computer to write a new data base program tailored specifically to your needs. The program is simple and easy to use and has nice features.

Although *Modifiable Database* is basically a RAM-based product, it's able to check other files on the same disk and even span disk drives when searching for a particular item. Two program add-on modules are available at extra cost: one is a printer module that can be used to generate a variety of output formats; the other is a math package that permits the addition, subtraction or multiplication of various entries. The sort routine, written in machine language, is one of the fastest around.

DB Master, a $189 program from Stoneware Microcomputer Products for Apple computers, is written in Applesoft BASIC. It comes on a copy-protected diskette. You don't get a backup disk with the package, but if you return the registration card, Stoneware provides a free backup disk. Ordinarily this would be a good deal, but in the case of *DB Master*, buyers should beware. Unlike most registration cards that come with software, (which contain the serial number of a program) this card forces the owner to agree to a license agreement that seems to be against his best interests. So if a user doesn't like the terms of the agreement, he's stuck without a backup.

To be fair, Stoneware makes this agreement visible on the outside of its package so that potential customers can see it and it starts off by saying, "When you open this diskette package you have automatically signed this agreement." It's hard to know how enforceable such a statement is, but it should cause you to think twice; after reading the agreement, you just may decide to forget about using this otherwise fine software package.

Among other things, you automatically agree that the serial number on your disk is unique and if a duplicate disk with that serial number turns up somewhere else, you have breached the terms of the licensing agreement. How do you know the serial number is unique? You don't. According to the agreement, you must also promise to use the program for a business application and not for personal or household use. Talk about Big Brother. This is absurd.

The agreement also contains a disclaimer of warranties that is fairly standard in the industry but it also says that the customer assumes the entire cost of all necessary repair, servicing and correction. If the disk bombs, or even fails to operate the way it should, the customer appears to have agreed that he has to pay for

a new copy of the program.

Another gem is, "Customer shall not be entitled to specific performance in connection with the licensed program of this agreement." Even if the program doesn't work the way the firm says it should, you have no recourse.

The best is yet to come, however. Under a section labelled "Liquidated Damages," the customer really gets nailed. Here the purchaser agrees that damages caused by copying of the software would be difficult to prove and that seeking adequate remedy against the cutomer would be inconvenient and not feasible. So, the customer agrees to pay $2,500 for each breach of the agreement by unauthorized use or copying or distribution. The customer further agrees that $2,500 is reasonable. Really!

What Stoneware seems to be saying is that if you buy this program and use it for personal or household applications, which are unauthorized uses, you have to pay a penalty of $2,500. Also, if another disk with your serial number turns up somewhere, you have to pay $2,500, even if you know the copy wasn't made from your disk. How difficult do you think it is to modify a serial number? Is any program really worth all this hassle? It's a question you have to answer yourself.

Despite all this, *DB Master* is a good product. Documentation for the package is excellent and consists of a 7.5-by 10-inch padded loose-leaf binder with approximately 125 pages of documentation, which include a table of contents and something not found often enough in software manuals—an index. The documentation is comprehensive and easily understandable with a step-by-step tutorial to guide the way.

ISAM is used

DB Master uses the ISAM storage method mentioned earlier. Records are stored and maintained automatically in their primary key order. The primary key is user-defined and includes the first field, or fields (up to four), in the record. Any record on the disk can be retrieved in about 3 seconds if requested by its primary key, and in about 7 seconds if requested by a secondary key. Any number of secondary keys can be used.

The storage capacity of DB Master is impressive. It can handle up to 1020 bytes (characters) per record and records can be organized in up to 100 fields. The fields can be arranged in up to nine screen pages per record. Unlike most other DBM programs, this one spans disk drives and supports multi-diskette files so that a data base of between one and five megabytes is possible.

The people at Stoneware seem to have thought of everything, including a small rubber washer and instructions on how to install it so that you can eliminate accidental resetting of your computer.

Another well thought out DBM program, available for the Apple and TRS-80 Model I, is Personal Software's *CCA Data Management System*. Versions of the same program for CP/M, the TRS-80 Model II and S-100 systems that use Micropolis disk drives are available from Custom Electronics Inc. In addition, Custom has run the BASIC source code for the program through a compiler and sells the faster-running version of the program for $185. The TRS-80 Model II version in BASIC costs $150 as does the Micropolis version. The CP/M version with the source code listing costs $250. According to Custom Electronics, an Atari version of the program, written in Atari BASIC, will be available by April. The price will be $99.95, the same price as the Apple version from Personal Software.

The cheapest version of the program is the one for the TRS-80 Model I, at $74.95. This is also an early version which uses a straight sequential data storage and retrieval technique. The Model I version of CCA is distributed on tape, probably to overcome Tandy's unwillingness to license use of its DOS to outside software producers. The manual that comes with the program, however, tells you that the program included comes on a diskette, and no instructions for transferring the program to disk are given.

Except for the Model I version, all other *CCA* versions use an ISAM storage technique. The entire program, including the sort routine, is written in BASIC. A modified Shell-Metzner sort is used, and up to 10 fields can be sorted simultaneously. The sort is modified in that it can do an alphanumeric sort in ascending and descending order and the sort has merge capabilities. The program can merge up to ten fields. An average file of 500 records can take 40 minutes to sort. Custom is now developing a machine language sort package that will soon be added to its versions of the program.

The *CCA Data Management* system features a packing technique that permits it to store more information on a diskette than is normally possible. Known as "spanned and blocked records," the technique stores multiple records per diskette sector instead of the more commonly used method of one record per sector. The total size of a *CCA* record is limited to 232 characters and the maximum number of fields allowed is 24.

Off to see the wizard

Commodore's *OZZ The Information Wizard*, is imported from England where Commodore is the king of personal computers. This program, priced at $395, is designed to be run on only the Model 8032 computer with the higher density 8050 disk drive unit.

OZZ is a fast machine language program, customizable even by someone unfamiliar with computer programming. Like *DB Master*, *OZZ* allows you to set up your own screen as a blank form which can then be used to prompt you to enter information.

The program can perform calculations on numerical data in different fields with a precision of 14 digits. Functions that can be performed are addition, subtraction, multiplication, division and percent. Up to 16 steps can be programmed in the calculator mode.

The maximum number of files in the data base is 10; the maximum number of bytes per record is 252. You can have 64,000 records in each file or until the disk is filled to capacity. Record structure is user-definable but the key for the record must be the first text field on the screen; storage technique is direct access, dynamic allocation. In this technique, the locations of data are stored on one disk of a dual drive configuration (call it disk A) while the actual data are stored on the other

Under $30 DBM programs for the TRS-80

The GAPP (Gallie All-Purpose Program) is full of surprises for such an inexpensive data-base program ($9.50). For example, it has a built-in keyboard debounce program, which can be deleted if you need the upper-memory space for something else.

Each record uses a three-line format, with line 1 containing a "key" code and—for an address list—the name, address, city, state and ZIP code—all on line 1! Slash marks (/) are used to provide formatting. The other two lines allow you to input just about any kind of alphanumeric date or codes you want. Each of the three lines can contain up to 255 characters!

A powerful free-form search routine will seek a specified string or partial string anywhere on any specified line or within each record, or an AND or OR search for *two* specified character groups. I tried a 5-character search through one line of each of 28 records, and it took 20 seconds. The same search through 28 *entire* records took 45 seconds (two lines in each record). During the search, the program displays subtotals as it tallies numerical values at the left end of a specified line in each "found" record. It also prints each found record in a speed format. This makes the program suitable for simple ledger and checking account use.

If you have an 80-column printer, you'll love this program even more! You can have output to the printer in 3-across, 4-line label format, with all codes (except ZIP code) hidden, and perfectly spaced for standard 8½ X11 self-adhesive label sheets. One-across labels are optional. You can also have a "file" listing of each complete record, with all codes (such as phone number, sort codes, dates, etc.) three across, or a straight line listing of each complete record. Furthermore, the records are saved to tape (5 seconds or 50 per record) with the same menu command.

Except for the slow cassette write/read speed, this program has a lot going for it—and the price is well-below it's value. I'd recommend this for short mailing lists — 50 names and addresses or less. Your imagination will find other uses, too.

Info Box

If you are presently using a card-file to store information, you'll *love* InfoBox. Written in machine language, it is extremely fast and versatile, with over 20 different commands and an excellent, highly-detailed 15-page manual.

Over 400 records, containing up to 28 characters each, can be held in a 16K memory. Longer records may also be used—up to 255 characters—but this reduces the number of records. Loading and saving data is performed in a continuous stream to a cassette or Stringy Floppy wafer. This means loading or saving about 2 records per second on cassette, or 28 records per second on wafer.

InfoBox will not sort entries; each new entry is simply added to the end of the existing entries. However, a free-form search is very flexible in application. You can search for *any* portion of the data in any record, or for *all* records. Once found, the entire record (or records) is displayed or printed. You can limit the search range, with a user-defined "first" and "last" record. You can also search each record for *beginning* characters only. A typical name search through 250 records takes only about 2 seconds! The search routine even provides an asterisk (*) as a "wild card" to represent any character.

You can enter codes, names, addresses, dates, or whatever you want. Limited screen and printer formatting is provided with the down-arrow key. The printer can be toggled on and off with a single-key command without exiting the program. There are no entry delays, since there is no sorting performed on entry.

The editing functions are performed on each character within a record in almost the same manner as BASIC Level II editing.

Scelbi's PIMS

Just the opposite of another program reviewed here, this one looked great when I began using it, but several serious flaws left me with a very negative feeling about PIMS. This program has had more publicity than any of the other data-base programs I reviewed, since the book describing the program is published by Scelbi, a major computer book publisher. The 84-page book is very well written, and contains the entire program listing in TRS-80 Level II BASIC.

I don't know of any source for this program on cassette, but Exatron Corporation (see FMS) sold the program on a wafer for only $3.95 until early 1980, when they came out with FMS. The wafer-version of PIMS was modified to use the Stringy Floppy for saving and loading DATA, and this was the version I tested.

PIMS operates with 11 primary commands, and some additional subcommands. HELP calls the primary commands to a screen listing. DATA can be entered from either the keyboard or tape. When entering via the keyboard, you must first define each field -up to ten - with a one to four character title, and then indicate if it is alphanumeric or numerical. There is a limit of 240 characters per record (that's *all* fields together), but the more characters per record, the fewer records that can be stored in a file. When DATA is entered from tape, the tape contains the field designations.

Once entered, any field in a record can be changed easily (by retyping that field). There is no character editing function.

Most data-base programs use sort and search routines. So does PIMS. However, both of these routines are among the slowest in any program received! For example, the SORT took 123 seconds to rearrange twenty-eight 4-line names and addresses in ZIP code order. I then commanded SORT by ZIP again, and it took 93 seconds even though they were *already* sorted!

The program allows you to SUM the total numeric value of a specific field for all records or records specified in a field SEARCH. Just for an exercise, I requested a SUM of the ZIP codes in my 28 name file. It took 96 seconds!

Calling a LIST of all records to the screen is *another* slow process! It took 94 second to LIST the 28 name-address-ZIP code records previously mentioned. That's far slower than referring to a card file.

For mailing purposes, a data-base program should output labels to a printer. PIMS does this. However, the labels are printed "one-up" — that is, not 3-across, as most self-adhesive label sheets are. If you have a printer that can handle roll-labels, then you might like PIM's LABELS command. The program forces you through three "alignment" labels before it gets to the records. Then it delays about three seconds *between* each label.

Incidentally, you can select a range of records to be LISTED on the screen, or for LABELS, *provided* you keep track of the record numbers.

The Exatron wafer version of PIMS has added some extra features (blinking cursor, fast load and save, defined field lengths, some additional commands), but I'm afraid even a stringy Floppy can't speed up the SORT, SEARCH, LIST and SUM routines. Therefore, I have to conclude that, although PIMS claims it can "improve your life style" and that "you can unleash the power of a personal computer for your own benefit," I found it impractical in real-world use.

Exatron's FMS

This program, with 18 primary commands and various subcommands, contains almost everything but the kitchen sink! It is only usable with an Exatron Stringy Floppy (ESF). You can use up to nine separate fields within each record, and each field can be alphanumeric, integer or single-precision. The mapping function provides full-screen-width placement of each field, including a separate line for each field, if desired. Any field can be hidden from screen or printer. Single-width printer labels can be placed anywhere between the left and right margins. A very fast entry sort keeps your list in order, and a complete resort, on any field, is relatively fast. Searches, starting at the beginning of any field, are very fast, and can be limited to a specific record range. Totals of any numeric field are also available.

The 30-page manual for FMS is very detailed. Despite the large number of commands, operation is quickly mastered. The menu, listing all primary commands, is easily called to the screen with BREAK or ENTER, and the program is virtually crashproof. A short (1 second) DATA I/O program is first loaded, then the FMS program (about 12 seconds). You then create a new file from the keyboard, defining the name and type of each field. Each record has a number, and editing any specified record is easily accomplished, although you must go through each field (with an ENTER) to reach the one you wish to change. Deletion of a record is also easy.

You can "quit" the program back to READY for examination of variables or calculations, and return to the program with CONT - provided you didn't edit or add any program lines. There's even a command to tell you the maximum number of records (of the kind in use). Unfortunately, a 16K memory is somewhat limiting, to about 60 records of 50 characters. However, shorter records yield more, so if you can use abbreviations and codes, you'll have more records.

disk (B). As the storage disk becomes full, data are stored on the disk (A) until the location table and the data meet at which point a "full disk" message is generated.

Aside from ease of use and superb human interface, *OZZ* has an excellent instruction manual that takes you through each step of getting the program up and running. Documentation is profusely illustrated with photos of the video screen so that you know what you're supposed to get. More than a reference manual, the book is a 12-lesson course on what the program is and how it's used. It would be very difficult for someone to read this manual and not be able to use *OZZ* the first time out.

Another DBM program for the Commodore line of computers is available from JINI Micro-Systems, Inc. Known as the *JINSAM Data Manager,* the program is available for practically every disk configuration of the various Commodore computers. Prices vary from $495 for the 80-column version that works on the 8032 computer, to $195 for the version that works with the 2040 unit. Written in BASIC, the program is supplied on a diskette with an accessory security ROM. Although the bulk of the program is BASIC, time consuming search and sort routines are written in machine language.

In Version 1.0, for use on the 2040, maximum record length is 255 characters (250 for the old ROMs). In Versions 4.0 and 8.0, there is no limit on the length of a record. Tests have been done using a record length of 1500 with no problems. The number of fields in a record is also unlimited. It should come as no surprise that there is no limit to the number of formatted screens that you can set up.

Like other high quality DBM programs, *JINSAM Data Manager* uses an ISAM storage and retrieval scheme and is menu-driven. A handy feature of the program is its built-in help routine. By typing HELP or just H, you can get additional information that helps you operate the program. The program allows you to delete, review, select or update records on the data base and provides for multiple primary keys and an unlimited number of secondary keys. Data can be recalled by key in ascending or descending order, by wild card search (a partial key recall), or by entering exact disk location. The system also has three levels of security. At level 1, no password is needed; at level 2, the correct password lets you display all fields of each record but does not permit modification of the record; at level 3, the right password lets you manipulate the entire data base, while level 4 permits you to redefine passwords.

Radex 10 for the TRS-80

Radex 10 for IJG Computer Services, is a disk-based DBM for Radio Shack's TRS-80 Model I computer. Priced at $99.50, the program has a record length of 255 characters and permits a maximum of 127 fields per record with a total capacity of 10199 records. The BASIC program uses random access storage and retrieval technique.

In operation, *Radex 10* sets up a bit table on one track of the drive 0 diskette. The bit table contains information as to which tracks and sectors are free and which are already occupied. A handy result of the way data are stored on diskette is that it's possible to delete information from the data base and then restore it at some later time. Although this is not always possible, it is if you use the data base properly.

Radex 10 is distributed on disk without a DOS, so you must have a two-drive system in order to transfer the program to a disk with DOS on it. While *Radex 10* is a good program as far as it goes, it doesn't go far enough. For example, if you want to delete or change fields in the data base without re-entering all the data, you can't do it unless you spend another $99.50, and if you want to sort and print a report, you have to buy a *Report Sort Module* for another $99.50 □

Need more information?

For more information on Data Base Management programs readers may consult the software producers and publishers listed here by circling the appropriate numbers on the reader-service card.

Adventure International, Box 3435, Longwood, FL 32750. (305) 862-6917. **CIRCLE 151**

Ashton-Tate, 3600 Wilshire Blvd., Suite 1510, Los Angeles, CA 90010. (213) 666-4409. **CIRCLE 152**

Blue Lakes Software, 3240 University Ave., Madison, WI 53705. (608) 256-5306. **CIRCLE 153**

Commodore Business Machines, Inc., 950 Rittenhouse Road, Norristown, PA 19401. (215) 666-7950. **CIRCLE 154**

Custom Electronics, Inc., 238 Exchange St., Chicopee, MA 01013. (413) 592-4761. **CIRCLE 155**

Data Access Corp., 4221 Ponce De Leon Blvd., Coral Gables, FL 33146. (305) 446-0669. **CIRCLE 156**

Exatron Corp., 181 Commercial Street, Sunnyvale, CA 94086. (408) 737-7111. **CIRCLE 157**

Fair Com, 2606 Johnson Drive, Columbus, MO 65201. (314) 445-3304. **CIRCLE 158**

Hayden Book Co., 59 Essex St., Rochelle Park, NJ 07662. (201) 843-0550. **CIRCLE 159**

High Technology, P.O. Box 14665, 8001 N. Classen Blvd., Oklahoma City, OK 73113. (405) 840-9900. **CIRCLE 160**

IJG Computer Services, 569 N. Mountain Ave., Suite B, Upland, CA 91786. (714) 946-5805. **CIRCLE 161**

JINI Micro-Systems, Inc., P.O. Box 274, Bronx, NY 10463. (212) 796-6200. **CIRCLE 162**

Manhattan Software, Inc., P.O. Box 5200, Grand Central Station, New York, NY 10017. **CIRCLE 163**

Micro Applications Group, 7300 Caldus Ave., Van Nuys, CA 91406. (213) 881-8076. **CIRCLE 164**

Micro Architect, Inc., 96 Dothan St., Arlington, MA 02174. **CIRCLE 165**

Micronybble Systems, 63 Dana St., Cambridge, MA 02138. **CIRCLE 166**

Miller Microcomputer Services, 61 Lake Shore Rd., Natick, MA 01760. (617) 653-6136. **CIRCLE 167**

NEECO, 679 Highland Ave., Needham, MA 02194. (617) 449-1760. **CIRCLE 168**

Personal Software, 1330 Bordeaux Dr., Sunnyvale, CA 94086. (408) 745-7841. **CIRCLE 169**

Programma, 2908 N Naomi St., Burbank, CA 91504. (213) 954-0240. **CIRCLE 170**

Radio Shack, 1300 One Tandy Center, Fort Worth, TX 76102. (817) 390-3011. **CIRCLE 171**

S & M Systems, Inc., P.O. Box 1225, 2 Washington St., Haverhill, MA 01830. (617) 373-1599. **CIRCLE 172**

Scelbi Publications, P.O. Box 3133, Milford, CT 06460. **CIRCLE 173**

Software Publishing Corp., P.O. Box 50575, Palo Alto, CA 94303. (415) 368-7598. **CIRCLE 174**

Stoneware Microcomputer Products, 1930 Fourth St., San Rafael, CA 94901. (415) 454-6500. **CIRCLE 175**

Structured Systems Group, Inc., 5204 Clarement Ave., Oakland, CA 94618. (415) 547-1567. **CIRCLE 176**

Synergistic Software, 5221 120th Ave. S.E., Bellevue, WA 98006. (206) 641-1917. **CIRCLE 177**

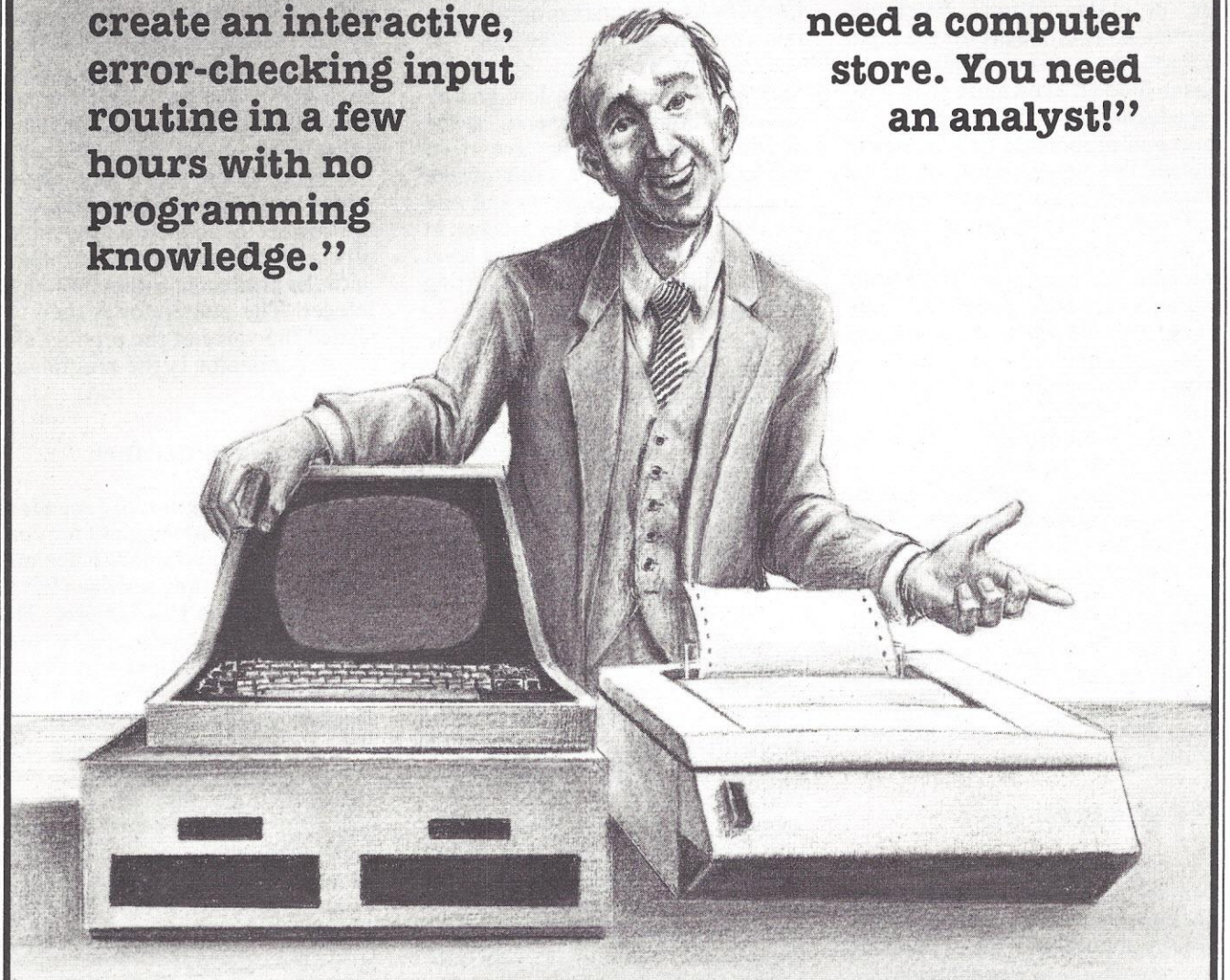
The Bottom Shelf, Inc., P.O. Box 49104, Atlanta, GA 30359. (404) 296-2003. **CIRCLE 178**

Tulsa Micro Systems, 114 West Taft, Sapulpa, OK 74066. (918) 224-4260. **CIRCLE 179**

United Software of America, 750 Third Ave., New York, NY 10017. (212) 682-0347. **CIRCLE 180**

SO THIS GUY WALKS INTO my store and says, "I want to define any data file, format the reports from it, and create an interactive, error-checking input routine in a few hours with no programming knowledge."

I TOLD HIM, "Buddy, you don't need a computer store. You need an analyst!"



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Circle 10

Fractional Arithmetic

BY DR. MARLENE MILKENT

I have always found it somewhat frustrating that computers, for all their intrinsic functions, provide no easy means for the input of fractions or mixed numbers. And I have found it even more so in writing educational programs related to ratio and proportion. It has always seemed like a step backward to give statement problems involving ratios and then have students use calculators in order to input their answer into the computer. It's a frustrating experience to have to explain to my students that this great m rvel of a computer is not designed to recognize something so simple fraction as ½ or 2 2/3.

Many educational programs, especially those dealing with measurement, ratio, proportion and, or course the manipulation of fractions themselves, could be made more convenient (and realistic) to students if values could be input in forms other than decimal notation. Also, there are many common situations, such as measuring lengths and converting recipes, which require the tedium of fraction manipulation or conversion.

Two subroutines used

I have developed two subroutines, one for the conversion of fractions or mixed numbers into decimal notation and the second for the conversion of decimal answers into their fraction or mixed number equivalents. I have incorporated these routines into a program called "Fraction Arithmetic."

"Fraction Arithmetic" is designed to be a general purpose program for performing mathematical operations with fractions. It should be particularly useful to architects, draftsmen or salesmen who must constantly deal with fractions in their profession. Students in the household should welcome the program as a means to check homework problems dealing with fractions. The program is especially applicable for household problems involving measuring and adding lengths, determining areas and converting recipes.

The program is structured into three levels. The main program contains the directions, allows for the selection of an option, prints the answer in decimal notation, and allows for return to the menu. At the second level, there are five subroutines—one for each of the four arithmetic operations and one for the conversion of the answer to fraction notation. At the third level is the subroutine for converting input into decimal notation.

The program is designed to handle negative values, but it does not recognize the "+" sign. In any given problem, the values may be entered as whole numbers, mixed numbers, fractions, or in decimal notation. An additional feature is that common input errors have been anticipated and, when one occurs, the user is asked to input that particular value again.

The program allows the user to select one of the four major arithmetic operations via a menu. When the problem is completed, the user is given the option of doing additional problems involving the same operation, returning to the menu, or terminating the program. For addition and multiplication, the user inputs the number of values to be used; for subtraction, the second value is subtracted from the first value; and for division, the second value is divided into the first value.

The four arithmetic subroutines are very similar in style. Each time a value (E$) is input, subroutine 1160 is called, and the values for the whole number part (W), the numerator (N) and the denominator (D) are determined. Upon return, a check is made for negative numbers and the appropriate mathematical operation is performed. The answer (A) is returned to the main program for output and for conversion to fraction notation.

The subroutine (1380) for converting the answer into fraction notation is relatively simple, and it will determine the fraction equivalent to the nearest 1/1000. First, if the number is negative, the minus sign is stored in SI$ and A is assigned the absolute value of A. The decimal part of the value (R) is determined by subtracting the integer of A from A. The numerator (N1) is assigned an initial value of 0 and the denominator (D1) is assigned an initial value of 2 at the beginning of a For-Next Loop. This loop determines the fraction equivalent with the lowest denominator by multiplying the decimal part by an integer until the product is within .001 of an integer. The numerator is then assigned the value of the product and the denominator is the multiplying factor (D1).

Fractions converted first

The entire program is dependent upon the subroutine (1160) for converting fraction notation to decimal notation. Each time a value (E$) is input, subroutine 1160 is called. The subroutine first checks to be sure E$ is not a null value, and then a check is made for the sign. If the number is negative, the minus sign is removed from the string and stored in SI$. The string is then checked to be sure there are no spaces in the fraction part—if one is found, the user is asked to enter the value again. Next, a check is made for a space in the string, and if one occurs, the value to the left of the string is assigned the whole number part (W) and removed. Next, the remaining string is searched for a slash, and if one is found, the value to the left of the slash is assigned the numerator and that to the right is designated as the denominator. If neither a space not a slash is found, the value is assumed to be a whole number or a decimal number and W is assigned the value of E$. W, N and D are returned to the calling subroutine for further operations.

One additional feature of the program is that for conversion of a single decimal value to its fraction equivalent, the addition option can be used. When 1 is given as the number of values to be added, the program will convert this value to a fraction. □

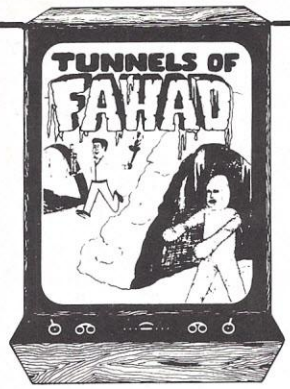
Program Listing

```
 10 REM    ********   FRACTION   ARITHMETIC    ***********
20 REM WRITTEN BY MARLENE M. MILKENT  SOUTHERN STATION BOX 8457  HATTIESBURG, MS   39401
30 REM    INSTRUCTIONS FOR ENTERING DATA
40 O$(1)="ADDITION":O$(2)="SUBTRACTION":O$(3)="MULTIPLICATION":O$(4)="DIVISION"
60 CLS:PRINT @0, STRING$(12,42);"  INSTRUCTIONS FOR ENTERING DATA  ";STRING$(12,42)
80 PRINT @133,"IN ALL SECTIONS OF THIS PROGRAM, NUMERIC VALUES"
100 PRINT @197,"MAY BE ENTERED AS WHOLE NUMBERS, FRACTIONS, MIXED"
120 PRINT @261,"NUMBERS OR DECIMALS.  FOR MIXED NUMBERS, LEAVE"
140 PRINT @325,"ONE SPACE BETWEEN THE WHOLE NUMBER AND FRACTION PARTS."
160 PRINT @389,"ALL OF THE FOLLOWING ARE VALID:":PRINT @522,"2"
180 PRINT @586,"5 3/4":PRINT @650,"5/8":PRINT @714,"3.16"
200 PRINT @896,"PRESS ENTER TO CONTINUE.":INPUT Z
220 CLS:PRINT @69,"- - - - - FRACTION  ARITHMETIC - - - - -"
230 REM   SELECTION OF OPTION
240 PRINT @197," OPTIONS:"
260 FOR I=1TO4:PRINT TAB(10),I;O$(I):NEXT I
280 PRINT:PRINT "DO YOU WANT OPTION 1, 2, 3, OR 4"
300 INPUT OP:IF OP<1 OR OP>4 PRINT "1, 2, 3, OR 4":GOTO300
310 REM  APPROPRIATE SUBROUTINE IS CALLED
320 CLS:ON OP GOSUB 480  ,640  ,820  ,980
330 REM  THE ANSWER IS PRINTED
340 PRINT:PRINT "THE ANSWER IS ";A
350 REM  CALL FOR SUBROUTINE TO CONVERT ANSWER TO A FRACTION
360 IF ABS(A-INT(A))>.00099 GOSUB 1380
370 REM  OPTIONS FOR ADDITIONAL CALCULATIONS
380 PRINT:PRINT "DO YOU WANT TO DO ANOTHER ";O$(OP);" PROBLEM"::INPUT Z$
400 IF Z$="YES" Z$="":GOTO 320
420 IF Z$<>"NO" GOTO 380
440 IF Z$="NO" INPUT "DO YOU WANT TO DO A DIFFERENT TYPE PROBLEM";Z$
460 IF Z$="YES" THEN 220  ELSE END
470 REM
473 REM  SUBROUTINE FOR  FRACTION ADDITION
475 REM
480 CLS:PRINT @89,"FRACTION ADDITION"
500 PRINT:INPUT"HOW MANY NUMBERS ARE TO BE ADDED";M
520 REM  ::::NOTE:::: M=1 IS EQUIVALENT TO CONVERSION OF A DECIMAL TO A FRACTION
530 REM  LOOP FOR THE INPUT OF NUMERIC VALUES
540 A=0:FOR K=1TOM
550 REM  ALL VALUES ARE READ AS STRINGS (E$)
560 PRINT "WHAT IS THE VALUE OF NUMBER ";K:INPUT E$
570 REM  CHECK FOR THE SIGN OF THE NUMBER
580 GOSUB 1160 : IF SI$="-" A2=-(W+N/D) ELSE A2=W+N/D
590 REM  CUMULATIVE SUM IS DETERMINED
600 A=A+A2:NEXT K
620 RETURN
630 REM
634 REM  SUBROUTINE FOR FRACTION SUBTRACTION
637 REM
640 CLS:PRINT @89,"FRACTION SUBTRACTION"
660 CLS:PRINT @69,"THE SECOND NUMBER YOU ENTER WILL BE"
680 PRINT @133,"SUBTRACTED FROM THE FIRST NUMBER ENTERED":PRINT
690 REM  FIRST VALUE IS INPUT AND ITS NUMERIC EQUIVALENT DETERMINED
700 INPUT "WHAT IS THE FIRST VALUE";E$:GOSUB 1160
720 IF SI$="-" THEN A1=-(W+N/D)ELSE A1=W+N/D
730 REM INPUT OF SECOND VALUE
740 PRINT:INPUT "WHAT IS THE SECOND VALUE";E$:GOSUB 1160
760 IF SI$="-" THEN A2=-(W+N/D) ELSE A2=W+N/D
780 A=A1-A2
800 RETURN
810 REM
813 REM SUBROUTINE FOR FRACTION MULTIPLICATION
816 REM
820 CLS:PRINT @89, "FRACTION  MULTIPLICATION"
830 REM INPUT OF NUMBER OF VALUES TO BE ENTERED
840 PRINT:INPUT "HOW MANY NUMBERS ARE TO BE MULTIPLIED";M
860 IF M<2 PRINT:PRINT"YOU ENTERED INCORRECT DATA":GOTO840
870 REM LOOP FOR INPUT OF VALUES
880 A=1:FOR K=1TOM:PRINT "WHAT IS THE VALUE OF NUMBER ";K:INPUT E$
900 GOSUB 1160
920 IF SI$="-" THEN A2=-(W+N/D) ELSE A2=W+N/D
940 A=A*A2:NEXT K
960 RETURN
970 REM
973 REM SUBROUTINE FOR FRACTION DIVISION
976 REM
980 CLS:PRINT @21,"FRACTION DIVISION"
```

```
1000 PRINT @261,"THE SECOND NUMBER YOU ENTER WILL BE DIVIDED"
1020 PRINT @325,"INTO THE FIRST NUMBER ENTERED."
1030 REM INPUT OF FIRST VALUE
1040 PRINT:INPUT "WHAT IS THE FIRST NUMBER";E$:GOSUB 1160
1060 IF SI$="-" THEN A1=-(W+N/D) ELSE A1=W+N/D
1070 REM INPUT OF SECOND VALUE
1080 PRINT:INPUT "WHAT IS THE SECOND NUMBER";E$:GOSUB 1160
1100 IF SI$="-" THEN A2=-(W+N/D)ELSE A2=W+N/D
1120 A=A1/A2
1140 RETURN
1142 REM
1144 REM  ****  ***  SUBROUTINE FOR DETERMINING NUMERIC VALUES ****
1146 REM
1150 REM FIRST, A CHECK IS MADE TO BE SURE A NULL VALUE WAS NOT ENTERED
1160 L=LEN(E$):IF L=0 PRINT "ENTER THE VALUE AGAIN":INPUT E$:GOTO1160
1170 REM W IS THE WHOLE NUMBER, N IS THE NUMERATOR, D THE DENOMINATOR AND SI$ THE SIGN
1180 W=0:N=0:D=1:SI$=""
1190 REM CHECK FOR AND EXTRACTION OF NEGATIVE SIGN
1200 IF LEFT$(E$,1)="-" SI$="-":E$=RIGHT$(E$,L-1):L=LEN(E$)
1210 REM CHECK FOR SPACES IN THE FRACTION PART
1220 FOR I=1TOL:IF MID$(E$,I,2)=" /"OR MID$(E$,I,2)="/ " PRINT"YOU CAN'T HAVE SPACES
IN THE FRACTION PART- -ENTER AGAIN":INPUT E$:GO TO 1160
1240 NEXT I
1250 REM IF A SPACE OCCURS IN THE STRING (E$),THE VALUE OF
1252 REM THE STRING TO THE LEFT OF THE SPACE IS ASSIGNED TO W.
1254 REM E$ THEN BECOMES THE PART OF THE STRING TO THE RIGHT
1256 REM OF THE SPACE AND L THE LENGTH OF THE STRING.
1260 FOR I=1 TO L:IF MID$(E$,I,1)=" " W=VAL(LEFT$(E$,I-1)):E$=RIGHT$(E$,L-I):L=LEN(E$):GOTO 1300
1280 NEXT I
1290 REM E$ IS CHECKED FOR THE /. THE VALUE TO THE LEFT IS
1292 REM ASSIGNED TO N, THAT TO THE RIGHT IS ASSIGNED TO D
1300 FOR I=1TOL:IF MID$(E$,I,1)="/" N=VAL(LEFT$(E$,I-1)):D=VAL(RIGHT$(E$,L-I)):GOTO 1360
1320 NEXT I
1330 REM IF NEITHER A SPACE NOR A / WAS FOUND, THEN
1332 REM THE VALUE IS A WHOLE NUMBER AND W IS ASSIGNED
1334 REM THE VALUE OF E$.
1340 IF W=0 W=VAL(E$)
1360 E$="":RETURN
1366 REM
1370 REM  *** ***    SUBROUTINE FOR DETERMINING THE EQUIVALENT FRACTION  *** ***
1373 REM
1375 REM  N1 = NUMERATOR, D1=DENOMINATOR
1377 REM N1 IS ASSIGNED A VALUE OF 0 AND
1378 REM A CHECK IS MADE FOR THE SIGN
1380 N1=0:IF A<0 A=ABS(A):SI$="-"ELSE SI$=""
1390 REM THE DECIMAL PART (R) IS DETERMINED
1400 R=A-INT(A)
1410 REM LOOP FOR DETERMINING THE FRACTION OF LOWEST DENOMINATOR
1412 REM THIS LOOP WILL DETERMINE A FRACTION UP TO 999/1000.
1420 FOR D1=2 TO 1000
1424 REM BEGINNING WITH D1=2, R IS MULTIPLIED BY D1 UNTIL THE
1425 REM PRODUCT IS WITHIN .001 OF AN INTEGER.  THE PRODUCT
1426 REM IS ASSIGNED TO THE NUMERATOR AND D1 REMAINS AS THE DENOMINATOR.
1427 REM D1 IS CONVERTED TO A STRING AND THE SPACE WHICH APPEARS
1428 REM AUTOMATICALLY IS REMOVED.
1440 IF ABS(R*D1-INT(R*D1+.001))<.00099 N1=INT(R*D1+.001):D$=STR$(D1):L=LEN(D$):
D$=RIGHT$(D$,L-1):GOTO1480
1460 NEXT D1
1470 REM THE WHOLE NUMBER PORTION OF A IS CONVERTED TO A STRING
1480 IF INT(A+.001)=0 A2$="" ELSE A2$=STR$(INT(A+.00099))+" "
1490 REM ALL THE "PIECES" ARE CONCATENATED INTO R$
1500 R$=SI$+A2$+STR$(N1)+"/"+D$
1520 PRINT:PRINT "THIS IS ALSO (OR APPROXIMATELY) = ";R$
1540 RETURN
```

Sample Run

```
   *  *  *   SAMPLE RUN   *  *  *
********** INSTRUCTIONS FOR ENTERING DATA **********
IN ALL SECTIONS OF THIS PROGRAM, NUMERIC VALUES
MAY BE ENTERED AS WHOLE NUMBERS, FRACTIONS, MIXED
NUMBERS OR DECIMALS.  FOR MIXED NUMBERS, LEAVE
ONE SPACE BETWEEN THE WHOLE NUMBER AND FRACTION PARTS.
ALL OF THE FOLLOWING ARE VALID:
2
5 3/4
5/8
3.16
PRESS ENTER TO CONTINUE.
?
 -  -  -  -  - FRACTION  ARITHMETIC -  -  -  -  -
 OPTIONS:
                1           ADDITION
                2           SUBTRACTION
                3           MULTIPLICATION
                4           DIVISION

DO YOU WANT OPTION 1, 2, 3, OR 4
? 1
 FRACTION ADDITION

HOW MANY NUMBERS ARE TO BE ADDED?  4
 WHAT IS THE VALUE OF NUMBER  1
? 1 2/3
 WHAT IS THE VALUE OF NUMBER  2
? 3.75
 WHAT IS THE VALUE OF NUMBER  3
? 6
 WHAT IS THE VALUE OF NUMBER  4
? 2/5

THE ANSWER IS  11.8167

THIS IS ALSO (OR APPROXIMATELY) =  11  49/60

DO YOU WANT TO DO ANOTHER ADDITION PROBLEM?  NO
 DO YOU WANT TO DO A DIFFERENT TYPE PROBLEM?  YES
 -  -  -  -  - FRACTION  ARITHMETIC -  -  -  -  -
 OPTIONS:
                1           ADDITION
                2           SUBTRACTION
                3           MULTIPLICATION
                4           DIVISION

DO YOU WANT OPTION 1, 2, 3, OR 4
? 2
 FRACTION SUBTRACTION
THE SECOND NUMBER YOU ENTER WILL BE
SUBTRACTED FROM THE FIRST NUMBER ENTERED

WHAT IS THE FIRST VALUE?  3.25

WHAT IS THE SECOND VALUE?  6 1/3

THE ANSWER IS -3.08333

THIS IS ALSO (OR APPROXIMATELY) = - 3  1/12

DO YOU WANT TO DO ANOTHER SUBTRACTION PROBLEM?  NO
 DO YOU WANT TO DO A DIFFERENT TYPE PROBLEM?  YES
 -  -  -  -  - FRACTION  ARITHMETIC -  -  -  -  -
 OPTIONS:
                1           ADDITION
                2           SUBTRACTION
                3           MULTIPLICATION
                4           DIVISION

DO YOU WANT OPTION 1, 2, 3, OR 4
? 3
 FRACTION  MULTIPLICATION

HOW MANY NUMBERS ARE TO BE MULTIPLIED?  3
 WHAT IS THE VALUE OF NUMBER  1
? 1/4
 WHAT IS THE VALUE OF NUMBER  2
? 2/7
 WHAT IS THE VALUE OF NUMBER  3
? 3.05

THE ANSWER IS  .217857

THIS IS ALSO (OR APPROXIMATELY) =  61/280

DO YOU WANT TO DO ANOTHER MULTIPLICATION PROBLEM?  NO
```



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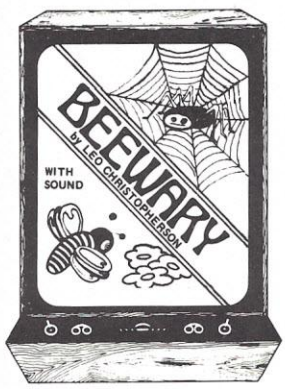
APPLE 2 32K TAPE 041-0015 $14.95
APPLE 2 32K DISK 042-0015 19.95

TRS-80 Model 1 TAPE 010-0086 $14.95
TRS-80 Model 1 DISK 012-0086 19.95



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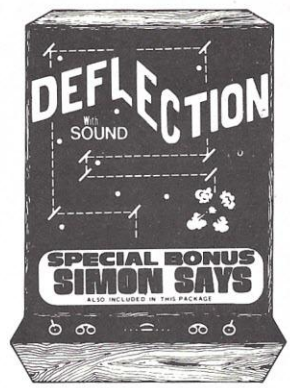
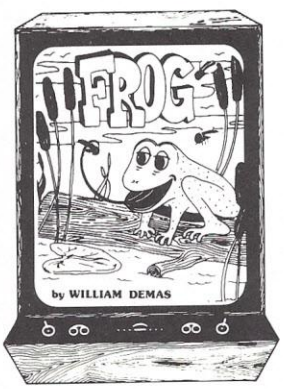


ATARI 400/800 TAPE to DISK 051-0078 $9.95



TRS-80 Mod 1 TAPE to DISK 011-0055 $ 9.95

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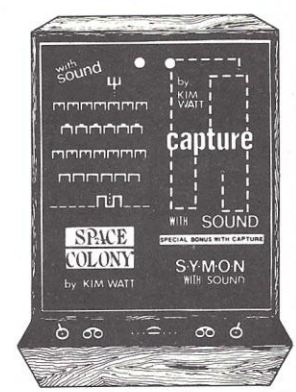
ATARI 400 800 Tape to Disk 051-0092 $ 9.95



Space Colony	TRS-80 Mod 1 TAPE	010-0053	$ 9.95
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CIRCLE 14

Program Index for TRS-80 Mini-Disk

C.A. DE ZOYSA

When we acquired our TRS-80 Mini-Disk drive with TRSDOS Version 2.3 a couple of months ago, my two sons and I saved, on several mini-disks, all the programs which we had previously recorded on tape. The programs had all been written in BASIC, and we had accumulated quite a collection during the two years in which we had owned our TRS-80 Level II.

We were all quite thrilled at the relative ease and speed at which the Mini-Disk system saved and loaded programs. What a relief not to have to juggle with tape saving and loading. However, we still backup all programs on tape just in case a disk fouls up. We don't mind this because tape backup is a one-time operation and is certainly worth the extra trouble.

With our combined library of programs occupying over 20 disks, it was quite a hassle figuring out which disk contained the program one of us was looking for. When we did locate the relevant disk, the name under which the program had been saved had to be known in advance to instruct the system to load it. This meant listing the directory (using the TRSDOS command DIR) to find out. It was also quite a nuisance to have to look up the directory to find out what other programs were on the disk. Besides, a seperate LOAD command was required whenever another program selection was desired.

In order to overcome these problems, I developed a short BASIC program, named INDEX, which we saved on each disk after adding the relevant data statements containing the titles and names of all the programs contained on that disk.

Retrieval of programs is certainly more convenient now. Each time a disk is inserted into the disk drive, we simply key RUN "INDEX", which then loads and runs the INDEX program. An indexed list of programs contained on the disk is then displayed on the screen. If more than 10 programs are stored on the disk, then the display will show 10 lines at a time under operator control. Option to select a program or to continue with the program index will appear after every 10 lines. You simply select the progam by entering the relevant index number. The selected program will then be loaded and run automatically. While loading, a handy message appears in 32 characters-per-line stating, "Program loading from disk now. Please wait."

When you have finished with a program and wish to select another, you run the INDEX program again, which will then give you the option of selecting any of the other programs in the disk. If you enter a zero or a number higher than the highest number in the index, the program will restart and display the index from the beginning. If you enter a non-numeric character, the computer will respond with a "Redo." Thus the program will not halt or produce undesirable results should you inadvertently hit a wrong key.

The program has been designed to store up to 30 program titles and corresponding program names. It makes use of READ/DATA statements. Clearance for adequate string space and dimensioning are carried out by lines 10 and 20. The program starts by reading the data into two simple arrays, A $(30) for program titles and B $(30) for program names. In order to simplify data entry, no end-of-data indicators are used. Instead, the program relies on an out-of-data error which is immediately trapped by an error trap in line 30 to prevent a program halt.

After the error trap, the program resumes at line 65, which disables the trap since its purpose has been served. Lines 70 to 130 print an indexed list of programs on the screen. Variable Q in line 110 acts as the line counter. Line 120 checks the line count. If there are less than 10 lines in the index, lines 170 to 200 are executed. If a selection from the index is made in either line 150 or 180, its validity is first tested in either line 160 or 200 and then in line 210. That is, if the selection is a zero, a non-existent index number or the ENTER key, the index will be resumed. If the selection is valid, lines 220 to 240 are executed to load the selected program from the disk.

To use the program, first enter lines 10 to 260 into your computer. Next, enter, as data, the titles (of your choice) and program names of all the BASIC programs in the selected disk. Data statements should be numbered from 270 upwards. The format of each data statement is as given in Figure 1,

Line No.	DATA	Program Title (Up to 55 Characters)		Program Name (Up to 8 alphanumeric characters)
		A$		B$

Figure 1.

Note: It is important that a comma be placed between the program title and the Program Name in the data statements. A list of sample data statements are given below. Enter some or all of them at the end of the program to obtain a sample run.

and should be strictly adhered to for proper operation.

EXAMPLE: 270 DATA BIRTHDAYS AND ANNIVERSARIES, DATES

In this case, the program title is "BIRTHDAYS AND ANNIVERSARIES," and the name under which the program has been saved in the disk is "DATES." Program names should consist of up to eight alphanumeric characters. Refer to file specifications in the TRSDOS manual. Should you wish to include commas or other punctuation marks in the program title, the entire title must be enclosed within quotes.

EXAMPLE: 280 DATA "COUNTRIES, CAPITALS, CURRENCIES & POPULATION", INFO 1

After all the data has been entered, save the index program using the command SAVE "INDEX". The above procedure should be carried out for each disk. As a result, each of your disks will have its own index program.

If at any time you delete a program from one of your disks, load the index programs and delete the data statement pertaining to the program. Then, SAVE the index program again. If you add a program to your disk, then you add a new data statement (containing the relevant program data) to your index program and SAVE it again. This is the method of updating your index program.

Because this program was written for a single drive system, those of you who possess more than one drive should specify the drive when issuing the RUN INDEX command.

EXAMPLE: RUN "INDEX" :3

This means that the index program in drive 3 will be loaded and run. When a program is selected however, the system will search the directories of all drives preceding drive 3 before actually loading it. This would mean a slight delay which, I trust, you can live with. When saving an index program on a multiple drive system, do not fail to specify the drive.

EXAMPLE: SAVE "INDEX" :1

The program will be saved on drive 1. If no drive is specified, drive 0 will be automatically used for both loading and saving operations. Consult your TRSDOS manual for more detailed instructions.

□

Program Listing

```
10 CLEAR 150
20 DIM A$(30), B$(30)
30 ON ERROR GOTO 250
40 FOR X = 1 TO 30
50 READ A$(X), B$(X)
60 NEXT X
65 ON ERROR GOTO 0
70 CLS: PRINT TAB (29) "INDEX": PRINT
80 Q = 0
90 FOR Y = 1 TO X-1
100 PRINT Y; "."; A$(Y)
110 Q = Q + 1
120 IF Q >9 THEN 170
130 NEXT Y
140 A = 0: PRINT STRING $(60, "—")
150 INPUT "ENTER SELECTION"; A
160 IF A = 0 THEN 70 ELSE 210
170 A = 0: PRINT STRING $(60, "—")
180 INPUT "ENTER SELECTION OR HIT ENTER FOR REST
    OF INDEX"; A
190 CLS:Q = 0
200 IF A = 0 PRINT TAB (29) "INDEX":PRINT:GOTO 130
210 IF A >(X - 1) THEN 70
220 CLS:PRINT CHR$(23):PRINT @ 448, "PROGRAM LOADING
    FROM DISK NOW"
230 PRINT @ 526, "PLEASE WAIT"
240 RUN B$(A)
250 RESUME 65
260 END
270 DATA BIRTHDAYS & ANNIVERSARIES, DATES
280 DATA "COUNTRIES, CAPITALS, & CURRENCIES", INFO 1
290 DATA BLACKJACK, BLAKJAK
300 DATA METRIC TABLES, METRIC
310 DATA BACKGAMMON, BAGAMON
330 DATA DEMONSTRATION PROGRAM, DEMO
340 DATA INVESTMENT ANALYSIS, MONEY
350 DATA "LIFE, AUTO AND HOMEOWNER POLICY NUMBER",
    INSURE
360 DATA SKETCH ..... A COMPUTERIZED SKETCH PAD,
    GRAPHICS
```

Sample Run

```
                                    INDEX

1. BIRTHDAYS & ANNIVERSARIES
2. COUNTRIES, CAPITALS, & CURRENCIES
3. BLACKJACK
4. METRIC TABLES
5. BACKGAMMON
6. DEMONSTRATION PROGRAM
7. INVESTMENT ANALYSIS
8. LIFE, AUTO AND HOMEOWNER POLICY NUMBER
9. SKETCH.....A COMPUTERIZED SKETCH PAD

ENTER SELECTION?—
```

Menu-Writer

BY KENNETH MILES

While developing a series of simple, menu-driven programs, it dawned on me that most of what I was doing for each program was re-writing the menu and appending routines that I had already developed. If I could eliminate or reduce the task of writing the menus, I would save a great deal of time.

Program Description

My first task was to delimit the scope of the menu section of the program to prevent the project from getting completely out of hand. As an informal definition, I decided to consider the menu portion of a program to include all lines which:

1. Display program options (together with accompanying instructions) to the user.
2. Accept the user's choice of options and cause a jump to an associated line.
3. Support the above described lines (required subroutines, DIM statements, etc.).

The second requirement of the program was that it must be much easier than manually generating a menu.

The Menu-Writer program is written in Applesoft Basic for the Apple II or Apple II Plus but can probably be modified to run under most common Basics. One disk drive is required.

Operation is straight forward. The user is prompted for answers to a series of questions about the data required to build a menu section for the object-program. This includes choice of the version of Basic to be used, names of certain variables and the options to be presented. Then, the program generates a test file of the object-program, which is saved to disk. This file is then tokenized by using the DOS 'EXEC' command. Multiple menus within one object-program are possible by simply avoiding conflicting line numbers and generating a separate text file for each menu. The text files, executed sequentially, append themselves together.

The Menu-Writer program will write a menu section for either Applesoft or Integer Basic, programs. The syntactical differences between the two versions of Basic are handled automatically. When writing a menu for an Applesoft program, Menu-Writer uses "CALL -936" to clear the screen, rather than "HOME". These are functionally identical, the only difference being that the "HOME" command uses one byte where the "CALL" uses four. If your program is so short on room that this matters, Menu-Writer will probably not write compact enough lines for your purposes anyway.

Instructions

Menu-Writer should be used at about the same stage of program development where you would normally type in the menu. To use the program, you must have decided already on the choices to be presented to the user, the line numbers pointed to by each choice, the text of any messages you want to accompany the menu, and the names of certain variables.

The first input required is "NAME OF PROGRAM:". This is the name the text file will be stored under on the disk, so any name acceptable to the DOS may be used. When the file is stored, ".MENU" will be appended to the name you supply.

Next, you'll be asked for the line number of the menu section, and the line number increment. Answer with whatever numbers will be compatible with the rest of your program. Menu-Writer writes multiple statements per line, so figure about 20 lines for an average size menu with five to ten options.

Next, the program requests the version of Basic you want. Simply touch I or A as appropriate. If you choose Integer Basic, the program will next ask for the "LINE NUMBER FOR 'DIM' STATEMENTS". In this line the object program will dimension any strings required in the menu section. This "DIM" statement is written automatically by Menu-Writer.

The program gives a short description of its "Header" writing capabilities, which are the titles, instructions or decorations that you want to appear at the top of the screen along with the menu selections. The Menu-Writer program will want to know certain facts about each line of this header: You may choose whether or not to have each line of the header centered; You may have any or all of the lines of the header followed by a screen wide line of characters (e.g. dashes); or, you may choose normal, inverse or flashing mode for each header line and/or its accompanying line of characters. All these choices are independent of each other. You may have up to five header lines with each menu. When you are finished entering header lines, type a "/" (slash) to proceed.

If you follow any header line with a line of characters, the program will next ask for the character to be used to draw the line. Although this can be any

Menu-Writer will write a menu section for either Applesoft or Integer BASIC Programs.

Mr. Miles, who holds an undergraduate physics degree and a Juris Doctor from Loyola University, works as a software support programmer.

printing character, it should normally be one of the non-alphanumerics (e.g. -,*, or #). The program will draw a line of these characters in all three display modes and ask if this is correct. Answer with a "Y" or "N"

Now you come to the actual options to be displayed. Simply type the text as you want it to appear. You should not number the options, since this will be done automatically. After each option, you will be asked the "LINE REFERENCE FOR ABOVE". This should be the line number which you want executed when the user chooses that particular item. A carriage return will end the list of options. Although Menu-Writer will accept up to 20 options, you may not be able to use this many since the total list of options, plus your Header, must fit in the 24 lines of the Apple's screen. The program will center the block of options in the space below the Header vertically and horizontally.

The program next asks: "TOUCH FORMAT?". If you answer with a "Y", you can make selections in the object program by merely touching the number/letter of your choice. Answering "N" will require a carriage return after each choice.

The next question is "NUMBERED SELECTIONS?". If you answer "N" the menu choices will be labeled with letters instead of numbers.

The object program will be written so that a string variable is used for all input, whether the options are lettered or numbered. This has the advantage of making your program a little more crash-proof. This string variable is then translated by the object program into a numeric variable that will be used to point to the chosen line number. When you are asked for the names of these variables, you should choose them to avoid conflict with other variable usage in your program. The only other restrictions on these variable names are those imposed by the version of Basic you are using; you must avoid reserved words.

The next two questions require a little explanation of the way the object program is expected to be designed. In attempting to standardize my programs, I've gotten into the habit of using one subroutine to center strings and one to draw lines of characters on the screen. When I wrote Menu-Writer, I incorporated this concept. The centering subroutine takes a string variable, calculates how many spaces must be skipped in order to center it, and then prints the string. Although this is a very simply routine, using it can save a great deal of room in a program that does a lot of centering. Similarly, the line drawing subroutine is called everytime the program needs a line of characters drawn at the current cursor vertical position.

When the Menu-Writer program asks if you want a centering routine to be supplied, a "Y" response will cause it to write the appropriate code. An "N" will suppress the code, but the object program *must* contain a subroutine to perform the centering task. The program next asks for the line number of the centering subroutine. This will be either the line number you want for writing the routine, or the line number that your own centering routine starts at.

The line drawing subroutine is similar. If you respond "N" when asked if you want a line drawing subroutine supplied, your program *must* contain one.

Although written for the Apple II, it should be easily adaptable to most types of BASIC.

After you have supplied the above information, there will be a short pause while the text file is created. The disk drive then runs while the file is stored, and finally the program announces it has completed its task.

The last step is to execute the file so the Basic editor can tokenize the program for normal storage and execution. First clear out the Menu-Writer program by typing "NEW". Next, change to the proper version of Basic. If there are any parts of your program that you have already input through the Keyboard, load them now. Finally, type "EXEC NAME.MENU", where "NAME" is the program name you gave to Menu-Writer for storage. After a short run of the disk drive, your program inserts the menu and is ready to store or complete. If you have more menus or submenus to create, simply repeat the entire process.

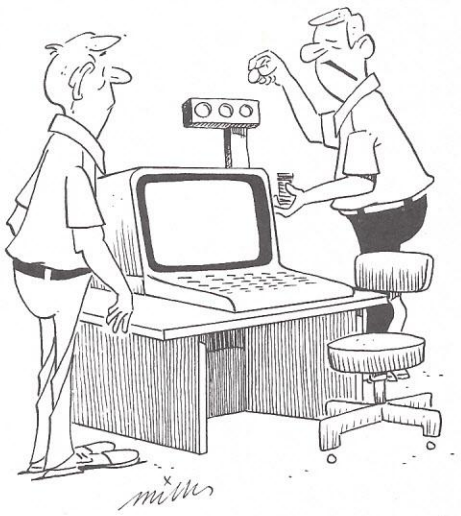
Although written for the Apple II, the Menu-Writer program should be easily adapted to most Basics. I've tried to provide adequate REM statements throughout the listing to make modifications simple. None of the REM statements are a referenced line number, so they may all be omitted without problems. I've made fairly extensive use of the "GET" command to input responses without the need for a carriage return. If your Basic does not support this, "INPUT" will work just as nicely.

In making modifications or additions, keep in mind that not only must you modify the Menu-Maker program so that it will run, but you must also modify it to write an object-program that will run. I found that the easiest approach was to start with a well written version of a sample object program. Then simply proceed through it, statement by statement and change/correct the Menu-Writer to generate the desired code.

Finally, although the program requires a disk as written, there appears to be a possibility that it might be modified for a tape based system.

I'd enjoy hearing from anyone who uses the Menu-Writer program and would like to discuss additions or extensions of it. Send your letters to the Feedback editor at *Personal Computing*, 50 Essex St., Rochelle Park, NJ 07662. □

Program listing on following pages.



"I lease it."

```
                    ******************************
                    *                            *
                    *        MENU-WRITER         *
                    *                            *
                    *     BY  KENNETH MILES      *
                    ******************************


1 D$ =  CHR$ (13) +  CHR$ (4)
2 E$ =  CHR$ (5)
3 CN$ = ":"
4  DEF  FN MD(X) =  INT ((X / 4 -  INT (X / 4)) * 4 + .05)
5  DIM AL$(40),CC$(40),I$(20),IP(20)
10  GOTO 1000
50  IF  LEFT$ (A$,1) = "Y" THEN A = 1: RETURN
51  IF  LEFT$ (A$,1) = "N" THEN A = 0: RETURN
52 A$ = "E": RETURN
60  GET A$: IF A$ = "N" THEN A = 0: PRINT "NORMAL": RETURN
61  IF A$ = "I" THEN A = 1: PRINT "INVERSE": RETURN
62  IF A$ = "F" THEN A = 2: PRINT "FLASH": RETURN
63  IF A$ = E$ THEN  PRINT : RETURN
64  PRINT  CHR$ (7): GOTO 60
70  GET A$: IF A$ = "Y" THEN A = 1: PRINT "YES": RETURN
71  IF A$ = "N" THEN A = 0: PRINT "NO": RETURN
72  IF A$ = E$ THEN  PRINT : RETURN
73  PRINT  CHR$ (7): GOTO 70
80  HOME : VTAB 10: RETURN
90  FOR J = 1 TO 40: PRINT LC$;: NEXT : PRINT : RETURN
500 AL$(LC) =  STR$ (CS) + TB$ + " (40-LEN(" + TV$ + "))/2" + CN$
501  REM  LINES 500-520 WRITE CENTERING SUBROUTINE
510 AL$(LC) = AL$(LC) + "PRINT" + TV$ + CN$ + "RETURN"
520 LC = LC + 1: RETURN
700 AL$(LC) =  STR$ (LS) + "FORI=1TO40:PRINT"
701  REM  LINES 700-730 WRITE LINE DRAWING SUBROUTINE
710 AL$(LC) = AL$(LC) +  CHR$ (34) + LC$ +  CHR$ (34) + ";:NEXTI:RETURN"
730 LC = LC + 1: RETURN
999  REM  START OF MAIN PART OF PROGRAM
1000  CALL  - 936: VTAB 10: FLASH : HTAB 15: PRINT "MENU WRITER": FOR J =
     1 TO 2000: NEXT : NORMAL
1010  HOME : VTAB 8: INPUT "NAME OF PROGRAM:  ";N$
1015  VTAB 8
1020  INPUT "INPUT THE FIRST LINE NUMBER OF THE MENU SECTION TO BE CONSTRU
     CTED:  ";FL: PRINT
1030  INPUT "INPUT THE LINE NUMBER INCREMENT: ";LI: PRINT
1033  PRINT "WHICH VERSION OF BASIC WILL YOU USE?    (INT.BASIC : APPLESOF
     TSOFT): ";: GET A$: IF A$ = "I" THEN BF = 0
1034  IF A$ = "A" THEN BF = 1
1035  PRINT : IF A$ <  > "I" AND A$ <  > "A" THEN 1033
1036  IF  NOT BF THEN  INPUT "LINE NUMBER FOR 'DIM' STATEMENT: ";DI
1040  CALL  - 936: PRINT "YOU MAY SPECIFY UP TO FIVE LINES OF     HEADINGS
     , EACH OF WHICH MAY OPTIONALLY  BE FOLLOWED BY A LINE OF CHARACTERS."

1050  PRINT "IN ADDITION, BOTH THE HEADINGS AND LINESMAY BE INVERTED OR FL
     ASHED."
1060  PRINT "INPUT A '/' TO END."
1495  INPUT "INPUT THE VARIABLE TO BE USED FOR       CENTERING THE TITLES:
     ";TV$
1500  FOR J = 1 TO NT: IF LF(J) = 1 THEN 1520
1510  NEXT J: GOTO 2000
1520  GOSUB 80: PRINT "DO YOU WANT A LINE DRAWING SUBROUTINE TOBE SUPPLIED
     BY THIS PROGRAM? ";: GOSUB 70
1530 LS = 1: IF A = 1 THEN LS =  - 1
1540  PRINT : INPUT "INPUT THE LINE NUMBER OF THE LINE DRAW  SUBROUTINE
     (YOURS OR THE ONE TO BE   CREATED BY THIS PROGRAM):  ";A$:LS = LS *
     VAL (A$)
1999  REM  LINES 2000 ET SEQ. CREATE THE TEXT FILE
2000 TB$ = "TAB": IF BF THEN TB$ = "HTAB"
2001  REM  LINES 2000 TO 2199 SET UP LANGUAGE SENSITIVE WORDS, AND MISC VA
     RIABLES.
2005 MV$(0) = "POKE 50,255": IF BF THEN MV$(0) = "NORMAL"
2010 MV$(1) = "POKE50,63": IF BF THEN MV$(1) = "INVERSE"
2015 MV$(2) = "POKE50,127": IF BF THEN MV$(2) = "FLASH"
2100 CL = FL:LC = 1
2110  IF CS < 0 THEN CS =  ABS (CS): GOSUB 500
2120  IF LS < 0 THEN LS =  ABS (LS): GOSUB 700
2200  FOR J = 1 TO NT
2201  REM  LINES 2200-2299 WRITE CODE FOR HEADERS
2210 AL$(LC) =  STR$ (CL)
2215  IF J = 1 THEN AL$(LC) = AL$(LC) + "CALL-936:"
2220  IF D1(J) > 0 THEN AL$(LC) = AL$(LC) + MV$(D1(J)) + CN$
2230 AL$(LC) = AL$(LC) + TV$ + "=" +  CHR$ (34) + T$(J) +  CHR$ (34) + CN$

2240  IF CF(J) > 0 THEN AL$(LC) = AL$(LC) + "GOSUB" +  STR$ (CS) + CN$: GOTO
     2250
2245 AL$(LC) = AL$(LC) + "PRINT" + TV$ + CN$
2250  IF D1(J) <  > D2(J) THEN AL$(LC) = AL$(LC) + MV$(0) + CN$
2260  IF LF(J) = 0 THEN 2295
2270  IF D2(J) > 0 THEN AL$(LC) = AL$(LC) + MV$(D2(J)) + CN$
2280 AL$(LC) = AL$(LC) + "GOSUB" +  STR$ (LS) + CN$
2290  IF D2(J) > 0 THEN AL$(LC) = AL$(LC) + MV$(0) + CN$
2295  IF  RIGHT$ (AL$(LC),1) = ":" THEN AL$(LC) =  LEFT$ (AL$(LC), LEN (AL
     $(LC)) - 1)
2300 LC = LC + 1:CL = CL + LI: NEXT J
2301  REM   LINES 2300 ET SEQ CALCULATE THE LEFT (LM) AND TOP MAGIN (TM) A
     ROUND THE LIST OF OPTIONS PRESENTED.
2400 NL = 0: FOR J = 1 TO NT:NL = NL + LF(J): NEXT
2410 TM = 24 - (NT + NL + NF + 2):TM =  INT (TM / 2): IF TM < 1 THEN TM =
     0
2420 TM = TM + NT + NL + 1
2430 LM = 0: FOR J = 1 TO NF: IF  LEN (I$(J)) > LM THEN LM =  LEN (I$(J))
2440  NEXT J:LM = LM + 4
2450 LM =  INT ((40 - LM) / 2)
2451  REM  GENERATION OF NUMBER/LETTER ARRAYS FOR CHOICES
2460  FOR J = 1 TO 20:CC$(J) =  STR$ (J): NEXT : IF TF = 1 THEN CC$(10) =
     "0"
2470  IF LF = 1 THEN 2500
2480  FOR J = 1 TO 20:CC$(J) =  CHR$ (J + 64): NEXT
2500  FOR J = 1 TO NF:AL$(LC) =  STR$ (CL)
2505  IF J = 1 THEN AL$(LC) = AL$(LC) + "VTAB" +  STR$ (TM) + CN$
2510  IF LM > 1 THEN AL$(LC) = AL$(LC) + TB$ +  STR$ (LM) + CN$
```

```
1080  IF  RIGHT$ (TV$,1) <  > "$" THEN TV$ = TV$ + "$"
1100  FOR J = 1 TO 5
1110  PRINT : VTAB 10: CALL  - 958
1120  PRINT "LINE "J;: INPUT " TEXT :";T$(J): IF T$(J) = E$ AND J > 1 THEN
      J = J - 1: GOTO 1110
1130  IF  LEN (T$(J)) = 1 AND T$(J) = "/" THEN 1260
1140  VTAB 11: CALL  - 958: PRINT "CENTER THIS LINE? ";: GOSUB 70: IF A$ =
      E$ THEN 1110
1160 CF(J) = A
1170  PRINT "MODE  (NORMAL:INVERSE:FLASH): ";: GOSUB 60: IF A$ = E$ THEN 1
      140
1180 D1(J) = A
1190  VTAB 13: CALL  - 958: PRINT "PRINT A LINE OF CHARACTERS FOLLOWING TH
      EABOVE TEXT?";: GOSUB 70
1205 LF(J) = A: IF A = 0 THEN 1230
1210  VTAB 15: CALL  - 958: PRINT "MODE FOR THE LINE OF CHARACTERS--
      (NORMAL:INVERSE:FLASH): ";: GOSUB 60: IF A$ = E$ THEN 1190
1215  IF A$ = "E" THEN  PRINT  CHR$ (7): GOTO 1210
1220 D2(J) = A
1230  PRINT : PRINT "CORRECT";: GET A$: IF A$ = "N" THEN 1110
1240  IF A$ <  > "Y" THEN 1230
1250  NEXT J
1260 NT = J - 1: FOR J = 1 TO NT: IF LF(J) = 1 THEN 1280
1270  NEXT J: GOTO 1300
1280  GOSUB 80: PRINT "INPUT THE CHARACTER USED TO DRAW LINE: ";: GET LC$:
      PRINT
1290  GOSUB 90: INVERSE : GOSUB 90: FLASH : GOSUB 90: NORMAL : PRINT : PRINT

      "CORRECT? ";: GOSUB 70: IF A = 0 THEN 1280
1300  CALL  - 936: PRINT "YOU MUST NOW INPUT THE SELECTIONS TO BE MADE AVA
      LIBLE IN THE MENU.              (35 CHARACTERS MAXIMUM EACH)"
1310  VTAB 10:NF = 1
1320  PRINT "SELECTION NUMBER "NF: INVERSE : FOR JJ = 1 TO 36: PRINT "-";:
      NEXT : HTAB 1: NORMAL : INPUT " ";A$: IF A$ = E$ AND NF > 0 THEN NF =
      NF - 1: GOTO 1320
1335  IF  LEN (A$) = 0 THEN NF = NF - 1: GOTO 1400
1340  IF  LEN (A$) > 35 THEN  PRINT  CHR$ (7): GOTO 1320
1350 I$(NF) = A$
1360  INPUT "LINE REFERENCE FOR ABOVE: ";IP(NF)
1370 NF = NF + 1: IF NF < 21 THEN 1320
1380 NF = NF - 1
1400  GOSUB 80: PRINT "TOUCH FORMAT (AS OPPOSED TO REQUIREMENT FOR A CARRI
      AGE RETURN)?  ";: GOSUB 70:TF = A:
1410  GOSUB 80: PRINT : PRINT "NUMBERED SELECTIONS (A 'N' WILL  FORCE  LET
      TERS)? ";: GOSUB 70:LF = A
1420  IF  NOT BF AND TF THEN  GOSUB 80: GOTO 1440
1430  GOSUB 80: INPUT "VARIABLE TO BE USED FOR INPUT: ";IV$: IF  RIGHT$ (I
      V$,1) <  > "$" THEN IV$ = IV$ + "$": PRINT
1440  PRINT : INPUT "INPUT THE NAME OF THE NUMERIC VARIABLE  TO BE USED TO
       POINT TO THE CHOSEN LINE  NUMBER:  ";PV$: IF  RIGHT$ (PV$,1) = "$" THEN

      PV$ =  LEFT$ (PV$, LEN (PV$) - 1)
1450  FOR J = 1 TO NT: IF CF(J) = 1 THEN 1470
1460  NEXT J: GOTO 1500
1470  GOSUB 80: PRINT "DO YOU WANT A CENTERING SUBROUTINE TO BESUPPLIED BY
       THIS PROGRAM? ";: GOSUB 70
1480 CS = 1: IF A = 1 THEN CS =  - 1
1490  PRINT : INPUT "INPUT THE LINE NUMBER OF THE  CENTERING SUBROUTINE
      (YOURS OR THE ONE TO BE    CREATED BY THIS PROGRAM): ";A$:CS = CS *  VAL
      (A$)
2520 AL$(LC) = AL$(LC) + "PRINT" +  CHR$ (34)
2530 AL$(LC) = AL$(LC) + CC$(J) + ".  " + I$(J) +  CHR$ (34)
2540 LC = LC + 1:CL = CL + LI: NEXT J
2600 AL$(LC) =  STR$ (CL) + "PRINT" + CN$
2610  IF TF THEN AL$(LC) = AL$(LC) + "PRINT" +  CHR$ (34) + "TOUCH KEY OF
      YOUR CHOICE --" +  CHR$ (34) + ";"
2620  IF  NOT TF THEN AL$(LC) = AL$(LC) + "PRINT" +  CHR$ (34) + "INPUT YO
      UR CHOICE --" +  CHR$ (34) + ";"
2630 LC = LC + 1:CL = CL + LI:TF = TF + 1: ON TF GOTO 3000,3200
3000 AL$(LC) =  STR$ (CL) + "INPUT"
3001  REM  WRITES NON-TOUCH FORMAT INPUT LINES.
3040 AL$(LC) = AL$(LC) + IV$ + CN$
3050 AS = 64: IF  NOT BF THEN AS = 192: IF LF THEN AS = 176
3060  IF  NOT (BF) OR  NOT LF THEN AL$(LC) = AL$(LC) + PV$ + "=ASC(" + IV$
      + ")-" +  STR$ (AS) + CN$: GOTO 3080
3070 AL$(LC) = AL$(LC) + PV$ + "=VAL(" + IV$ + ")"
3080 AL$(LC) = AL$(LC) + CN$ + "IF" + PV$ + "<1OR" + PV$ + ">" +  STR$ (NF
      ) + "THEN" +  STR$ (CL)
3090  GOTO 4000
3200 AL$(LC) =  STR$ (CL): IF  NOT BF THEN 3300
3201  REM  WRITES TOUCH FORMAT INPUT LINES
3210 AL$(LC) = AL$(LC) + "GET" + IV$ + CN$
3220  IF LF THEN AL$(LC) = AL$(LC) + PV$ + "=VAL(" + IV$ + ")" + CN$
3230  IF  NOT LF THEN AL$(LC) = AL$(LC) + PV$ + "=ASC(" + IV$ + ")-64" + C
      N$
3240 AL$(LC) = AL$(LC) + "IF" + PV$ + "<1OR" + PV$ + ">" +  STR$ (NF) + "T
      HEN" +  STR$ (CL)
3290  GOTO 4000
3300 AS = 192: IF LF THEN AS = 176
3310 AL$(LC) = AL$(LC) + PV$ + "=PEEK(-16384):IF" + PV$ + "<127 THEN" +  STR$

      (CL) + CN$ + "POKE-16368,0"
3320 AL$(LC) = AL$(LC) + CN$ + PV$ + "=" + PV$ + "-" +  STR$ (AS) + CN$
3330 AL$(LC) = AL$(LC) + "IF" + PV$ + "<1OR" + PV$ + ">" +  STR$ (NF) + "T
      HEN" +  STR$ (CL)
4000 LC = LC + 1:CL = CL + LI:AL$(LC) =  STR$ (CL): IF  NOT BF THEN 4200
4001  REM  WRITES APPLESOFT 'ON GOTO' STATEMENTS
4010 AL$(LC) = AL$(LC) + "ON" + PV$ + "GOTO" +  STR$ (IP(1))
4020  IF NF = 1 THEN 5000
4030  FOR J = 2 TO NF:AL$(LC) = AL$(LC) + "," +  STR$ (IP(J)): NEXT J
4050  GOTO 5000
4200  FOR J = 1 TO NF
4201  REM  WRITES INTEGER BASIC 'GOTO' ARRAYS
4210 JJ =  FN MD(J)
4211  IF JJ <  > 0 THEN 4240
4220 LC = LC + 1:CL = CL + LI:AL$(LC) =  STR$ (CL)
4240  IF (JJ = 1 AND J <  > 1) OR JJ = 2 OR JJ = 3 THEN AL$(LC) = AL$(LC) +
      CN$
4250 AL$(LC) = AL$(LC) + "IF" + PV$ + "=" +  STR$ (J) + "THEN" +  STR$ (IP
      (J))
4260  NEXT J
5000  IF BF THEN 10000
5010 LC = LC + 1:AL$(LC) =  STR$ (DI)
5020 AL$(LC) = AL$(LC) + "DIM" + TV$ + "(40)
9999  REM  STORES TEXT FILE TO DISK.
10000  PRINT D$"OPEN"N$",MENU": PRINT D$"WRITE"N$",MENU"
10020  FOR J = 1 TO LC: PRINT AL$(J): NEXT : PRINT D$"CLOSE"
10030  HOME : PRINT "TEXT FILE STORED": END
```

FIGURE I

```
                SAMPLE MENU
-----------------------------------------
THIS IS AN EXAMPLE OF HOW THE HEADER
LINES CAN BE USED TO GIVE INSTRUCTIONS
WITH THE MENU.
-----------------------------------------
THESE ARE THE CHOICES--



    1.  THIS IS THE FIRST SELECTION
    2.  THIS IS THE SECOND SELECTION
    3.  THIS IS THE THIRD SELECTION
    4.  THIS IS NUMBER FOUR
    5.  FIFTH CHOICE
    6.  LAST

INPUT YOUR CHOICE --
```

The sample Menu shown above was generated using the program segment shown in LISTING I. This is a 6 option Menu, with 5 lines of header. Lines 1 and 4 of the header are followed with a line of dashes. Note how the MENU-WRITER program has centered the list of options in the space below the header lines.

LISTING I

```
80  HTAB (40 -  LEN (A$)) / 2: PRINT A$: RETURN

90  FOR I = 1 TO 40: PRINT "-";: NEXT I: RETURN

1000  CALL  - 936:A$ = "SAMPLE MENU": GOSUB
    80: GOSUB 90
1010 A$ = "THIS IS AN EXAMPLE OF HOW THE HEA
    DER": PRINT A$
1020 A$ = "LINES CAN BE USED TO GIVE INSTRUC
    TIONS": PRINT A$
1030 A$ = "WITH THE MENU.": PRINT A$: GOSUB
    90
1040 A$ = "THESE ARE THE CHOICES--": PRINT A
    $
1050  VTAB 12: HTAB 4: PRINT "1.  THIS IS TH
    E FIRST SELECTION"
1060  HTAB 4: PRINT "2.  THIS IS THE SECOND
    SELECTION"
1070  HTAB 4: PRINT "3.  THIS IS THE THIRD S
    ELECTION"
1080  HTAB 4: PRINT "4.  THIS IS NUMBER FOUR
    "
1090  HTAB 4: PRINT "5.  FIFTH CHOICE"
1100  HTAB 4: PRINT "6.  LAST"
1110  PRINT : PRINT "INPUT YOUR CHOICE --";
1120  INPUT A$:A =  VAL (A$): IF A < 1 OR A >
    6 THEN 1120
1130  ON A GOTO 1000,2000,3000,4000,5000,600
    0
```

Above is the listing which was used to generate the menu which is shown in FIGURE I. The Menu is entered starting at line 1000. It shows the standard centering and line drawing subroutines at lines 80 and 90 respectively.

FIGURE II

```
          EXAMPLE OF A LONG MENU
*****************************************

          A.  FIRST CHOICE
          B.  SECOND CHOICE
          C.  THIRD CHOICE
          D.  FOURTH CHOICE
          E.  FIFTH CHOICE
          F.  SIXTH CHOICE
          G.  SEVENTH CHOICE
          H.  EIGHTH CHOICE
          I.  NINTH CHOICE
          J.  TENTH CHOICE
          K.  ELEVENTH CHOICE

TOUCH KEY OF YOUR CHOICE --
```

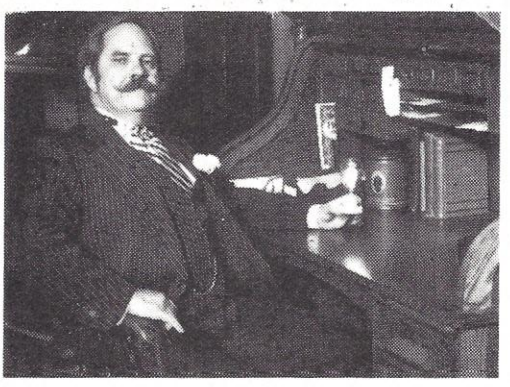
This menu was produced by the segment shown in LISTING II. Comparison with FIGURE I demonstrates the horizontal and vertical centering which is done automatically to place the list of choices in the center of the space below the heading.

LISTING II

```
10  CALL  - 936:A$ = "EXAMPLE OF
    A LONG MENU": GOSUB 300: GOSUB
    400
20  VTAB 7: HTAB 10: PRINT "A.  F
    IRST CHOICE"
30  HTAB 10: PRINT "B.  SECOND CH
    OICE"
40  HTAB 10: PRINT "C.  THIRD CHO
    ICE"
50  HTAB 10: PRINT "D.  FOURTH CH
    OICE"
60  HTAB 10: PRINT "E.  FIFTH CHO
    ICE"
70  HTAB 10: PRINT "F.  SIXTH CHO
    ICE"
80  HTAB 10: PRINT "G.  SEVENTH C
    HOICE"
90  HTAB 10: PRINT "H.  EIGHTH CH
    OICE"
100  HTAB 10: PRINT "I.  NINTH CH
    OICE"
110  HTAB 10: PRINT "J.  TENTH CH
    OICE"
120  HTAB 10: PRINT "K.  ELEVENTH
     CHOICE"
130  PRINT : PRINT "TOUCH KEY OF
    YOUR CHOICE --";
140  GET A$:A =  ASC (A$) - 64: IF
    A < 1 OR A > 11 THEN 140
150  ON A GOTO 1000,2000,3000,400
    0,5000,6000,7000,8000,9000,1
    0000,11000
300  HTAB (40 -  LEN (A$)) / 2: PRINT
    A$: RETURN
400  FOR I = 1 TO 40: PRINT "*";:
     NEXT I: RETURN
```

This program segment generated the menu shown in FIGURE II. Notice that the subroutines have been placed at the end of thelisting. Normally this should not be done, since it slows down their operation. Here it demonstrates the versatility of the MENU-WRITER program in adapting to meet the user's needs.

In the Business World of the 1880s the name to Reckon with



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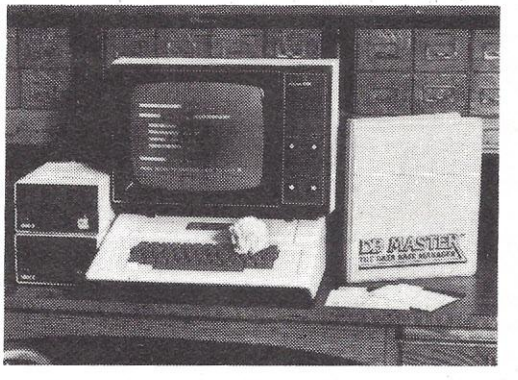
- Wild Card and Partial String Searches
- Report Generator includes computed fields, subtotal & page breaks, number formatting, multiple lines per record, code (table look up) fields, printer and screen reports and summary only reports
- Custom Disk Operating System . . . You won't believe how fast it is! (DOS 3.3 disk controller required)



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CIRCLE 15

Life Insurance Analysis

BY EDWIN K. HUNTER

It is a continual source of amazement to many otherwise well-informed consumers that there really are drastic, and sometimes monumental, differences in and among the various life insurance policies offered by the more than 1200 life insurers doing business domestically. While many would devote enormous time and effort in researching a major purchase such as a car or a house, the majority of life insurance buyers tend to place somewhat of a blind trust in their insurance agents, or at best will do some amount of comparison shopping between different agents and insurance companies.

However, unless an individual is really knowledgeable regarding the terminology of the insurance companies, it is highly unlikely that he or she will ever be able to discern the basic worth and, even more importantly, the real dollar costs of the policy in question — that is, until it's too late to do anything about it. The vast wealth of comparison indices and ranking scales developed by both the life insurance industry and consumer protection groups has done little to dispel the notion that most major life insurance plans are essentially interchangeable, mainly because these scales are almost as unintelligible to the layman as the policy fine print is itself.

The purpose of this article, and the accompanying program, is to present another approach for comparative analysis of life insurance policies. This method differs from conventional analyses in that it allows for the calculation of the presently available death benefit, or the amount of benefit available during any point of the policy's term. This refinement will allow the user to accurately compare similar policies offered by different insurers, as well as different policies offered by the same insurer.

Threshold Considerations

Before analyzing policies, the potential buyer should reflect on the competing insurers and agents. A good contract with a poor company may have less value than a poor contract with a good company. The life insurance industry, as a whole, has an outstanding record of paying just claims, but a few companies fail. Some states have demanding reserve requirements for companies doing business with their citizens. Other states have lax standards. Knowledgeable consumers place little faith in regulatory bureaucracy and conduct independent research. ***Best's Flitcraft Compend*** offers information for comparing insurers. Most public libraries have this publication in their reference sections. Usually, sophisticated insurance agents will loan a prospective purchaser the use of their copies.

A well trained insurance agent makes analysis easier. Insurers augment their policies with a variety of features: conversion privileges, waiver of premium on disability, automatic premium loans, guaranteed insurability for additional coverage in later years and incontestability clauses, to name only a few. Many of these features increase actuarial risk and, accordingly, tend to push premiums upward. An agent can assist in determining the utility of these options for particular purchasers and will summarize their availability from competing insurers. Good agents also make suggestions as to insurance needs and techniques for reducing the tax burdens associated with insurance ownership. In short, the policyholder might acquire an outstanding life insurance plan from a mediocre agent, but this result will follow from either hard work or good luck on the policyholder's part.

The Policies

One year, non-renewable term represents the most basic form of life insurance. The insurer makes only one promise — if the insured dies within the policy's one year term, it will pay the face amount of the policy to the named beneficiary. Most beneficiaries need protection for longer periods.

One year, renewable term has more practical applications. In this contract the insurer makes an additional promise — a guarantee that it will accept the coverage for one or more additional periods if the policyholder continues to pay premiums.

An annual term policy renewable for five years must command a higher aggregate premium over the period than five successive annual non-renewable policies, given the same overhead and profit factors. The difference lies in the insurer's inability to reject or penalize substandard risks that might arise during the period. An insured who develops a terminal illness at the end of the first year best illustrates the added risks assumed by the issuer of renewable contracts. The company would clearly decline further coverage in the case of a non-renewable policy. In the other instance, the policyholder would clearly renew, costing the company the face value of the policy less premiums paid.

Yearly rises in premiums characterize both the renewable and non-renewable annual term policies. Level premium term policies replace the stairstep premiums with a series of premium plateaus, usually of a five or ten-year duration. In essence, the policyholder pays a premium in the plateau's early years in return for a discount in its latter years. Another common species of the term family associates level premiums with shrinking face values. Such decreasing term policies parallel the annual, renewable term policies. The former holds the premium constant over time, while the latter holds the face value constant.

A term policy has no further use if the insured survives the risk period. It is a wasting asset. The family of non-forfeiture value policies has residual worth at the end of the risk period. Straight life and endowment policies fall into this family together with many others. In general, these policies have an appreciating cash surrender value. The policyholder may collect this sum at anytime prior to the insured's death by cancelling the policy. Usually, the contract also permits the policyholder to borrow from the insurer an amount equal to and secured by the cash surrender value. Some policies provide for automatic loans to pay current premiums, should the policyholder fail to remit timely. Other policies permit their owners to convert non-forfeiture values to paid up insurance at any time.

Mr. Hunter, a Louisiana lawyer, has recently presented a paper on "The Estate Tax Relief Provisions Compared to Insurance and Other Estate Planning Solutions".

Sample Run

Term Insurance Analysis

```
ENTRY AGE..... 37
INSURED'S GENDER..MALE
FACE VALUE OF POLICY.... 100000
AVERAGE TAX BRACKET.... 50 %
COST OF MONEY.... 9 %
```

AGE	AFTER TAX PREMIUM COST	DISCOUNTED ACTUARIAL VALUE	DISCOUNTED NET VALUE(COST)
37	$940.	$215.	-$725.
38	$928.	$216.	-$636.
39	$914.	$216.	-$553.
40	$900.	$219.	-$476.
41	$884.	$222.	-$405.
42	$866.	$225.	-$338.
43	$846.	$230.	-$275.
44	$824.	$234.	-$217.
45	$800.	$238.	-$163.
46	$774.	$243.	-$114.

AGE	DISCOUNTED ADVANTAGE	CUMULATIVE DISCOUNTED ADVANTAGE
37	-$725.	-$725.
38	-$636.	-$1,361.
39	-$553.	-$1,914.
40	-$476.	-$2,390.
41	-$405.	-$2,795.
42	-$338.	-$3,133.
43	-$275.	-$3,408.
44	-$217.	-$3,625.
45	-$163.	-$3,788.
46	-$114.	-$3,902.

Non-Forfeiture Insurance Analysis

```
ENTRY AGE..... 31
INSURED'S GENDER..MALE
FACE VALUE OF POLICY.... 5000000
AVERAGE TAX BRACKET.... 70 %
COST OF MONEY.... 15 %
```

AGE	AFTER TAX PREMIUM COST	DISCOUNTED ACTUARIAL VALUE	DISCOUNTED NET VALUE(COST)
31	$298,333.	$4,381.	-$293,952.
32	$298,333.	$42,018.	-$217,402.
33	$298,333.	$56,270.	-$169,313.
34	$298,333.	$56,341.	-$139,818.
35	$298,333.	$55,473.	-$115,100.
36	$298,333.	$47,042.	-$101,283.
37	$298,333.	$46,380.	-$82,597.
38	$298,333.	$39,531.	-$72,623.
39	$298,333.	$36,976.	-$60,550.
40	$298,333.	$34,431.	-$50,374.
41	$298,333.	$32,572.	-$41,171.
42	$298,333.	$27,943.	-$36,182.
43	$298,333.	$25,368.	-$30,393.
44	$298,333.	$23,000.	-$25,488.
45	$298,333.	$20,472.	-$21,691.
46	$298,333.	$18,206.	-$18,458.
47	$298,333.	$16,715.	-$15,167.
48	$298,333.	$14,834.	-$12,889.
49	$298,333.	$13,148.	-$10,959.
50	$298,333.	$11,989.	-$8,973.

* * * * * * * * * *

AGE	DISCOUNTED NET VALUE(COST)	CUMULATIVE DISCOUNTED NET VALUE(COST)
31	-$290,433.	-$290,433.
32	-$214,265.	-$504,698.
33	-$166,484.	-$671,182.
34	-$137,241.	-$808,423.
35	-$112,731.	-$921,154.
36	-$99,079.	%-$1,020,233.
37	-$80,527.	%-$1,100,761.
38	-$70,656.	%-$1,171,416.
39	-$58,679.	%-$1,230,095.
40	-$48,582.	%-$1,278,677.
41	-$39,448.	%-$1,318,126.
42	-$34,526.	%-$1,352,651.
43	-$28,790.	%-$1,381,442.
44	-$23,942.	%-$1,405,384.
45	-$20,196.	%-$1,425,580.
46	-$17,016.	%-$1,442,595.
47	-$13,781.	%-$1,456,377.
48	-$11,563.	%-$1,467,940.
49	-$9,692.	%-$1,477,631.
50	-$7,762.	%-$1,485,394.

The dichotomy between participating and non-participating demands careful attention. Participating policies incorporate conservative actuarial assumptions and then refund a portion of the premium in the event actual experience proves more favorable. These refunds, referred to, alternatively, as dividends or return of unearned premium, might not occur if the insurer suffers an unfavorable experience. Nonetheless, most states permit insurers to project anticipated refunds with disclaimers of various kinds. For analysis purposes, the net cost of a participating policy equals the current premium less the refund from the previous year's premium. However, the analyst must weigh the reliability of the participating insurer's projections.

Insurers sometimes combine dissimilar insurance forms in a single package. For example, some ordinary life policies permit the policyholder to purchase additional increments of paid up insurance with policy dividends. This option fits well with the needs of policyholders who intend to borrow the cash values to pay premiums, but wish unreduced death protection. A less common variation involves issuing one policy on two or more lives. Such a policy pays when one of the insureds dies and then terminates. These products, occasionally reminiscent of patent medicine concoctions, seldom meet the more common needs of the insurance buying public. A sophisticated agent can help the potential purchaser decide whether combinations serve a purpose.

Taxes

Policyholders pay premiums with after-tax dollars. Employer-paid group term plans provide the only noteable exception. Accordingly, the after-tax cost of any life insurance program increases with the policyholder's rate of income taxation. For purposes of analysis, before-tax cost converts to after-tax cost by dividing the premium by the percentage of income the policyholder retains after paying tax. In other words, the divisor equals one minus the applicable tax rate. The effective rate of tax equals the total tax burden divided by the total taxable income. The marginal rate is the tax rate borne on the last dollar earned. Either rate consistently used will produce meaningful comparisons.

Financed insurance plans follow many patterns. Typically, the policyholder pays the premiums and builds cash value for four out of the first seven policy years. In other years the policyholder makes the maximum loan available, applying the loan proceeds against the premium. Itemizing policyholders may deduct the interest expense associated with this arrangement when computing income tax liability. The overall effect resembles decreasing term in that the protection element shrinks as the policy loan grows. Upon analysis, a policyholder with substantial taxable income may find the arrangement preferrable to decreasing term. The fact that insurers frequently use more favorable actuarial assumptions for cash value insurance than for term adds luster to financed insurance plans.

Beneficiaries sometimes must pay tax on policy proceeds. Inadvertance or incompetent tax planning can even subject policy proceeds to income taxation. More usually, gift and death taxes burden the proceeds. Planning may minimize or eliminate these taxes, but if the prospect of such taxes appears likely, the analyst should consider them.

Common Indices

The National Association of Insurance Commissioners has adopted model life insurance solicitation regulations describing a number of comparison indices. In 1979, the Federal Trade Commission staff issued a report criticizing some of the NAIC indices and recommending adoption of the Linton Yield method for comparing certain policies, which is explained later. The life insurance industry, in turn, condemned the staff report, particularly attacking the feasibility of Linton Yield indexing. The presumptive experts cannot agree on an approach.

The so called "traditional method" for comparing life insurance costs has the advantage of simplicity. Essentially, it ranks policies on the assumption that they will remain in force for a specified period, usually twenty years. For a participating straight life policy, the analyst adds projected dividends over the period to the final cash value and subtracts total premiums. The analyst divides the resultant "net payment" by the number of years in the period to produce the "average payment". Listing policies in order of their average payments generates a ranking. In most cases the computation produces a positive rather than a negative number, indicating that the policyholder takes more out at the end than paid in over the years. What happened to that fundamental law of economics, "there's no such thing as a free lunch ? " Obviously, the traditional method ignores the time adjusted value of money.

The "interest-adjusted method" (sometimes referred to as the "equalized cost method" or the "time adjusted method") recognizes that a premium dollar paid today has a greater present value than a premium dollar to be paid a year later. It assumes, as with the traditional method, that the policy remains in force for a specified period. The analyst accumulates net premiums at a fixed interest rate (frequently 5%) over the ranking period. The resultant value subtracted from the end term cash surrender value and termination dividend, if any, produces the interest adjusted cost. In some systems, the analyst divides the interest adjusted cost per $1000 of insurance by a factor equal to the future value of an annuity of $1 annually accumulated at the selected interest rate over the specified period. The number generated in this variation is referred to as the surrender cost index.

Although both the traditional and interest-adjusted methods focus on non-forfeiture value contracts, an analyst might extend the underlying principles to term insurance. The analyst need only set the cash surrender value at zero. The Linton Yield method, on the other hand, only addresses non-forfeiture value insurance. This method assumes the existence of a term policy in every way identical to the non-forfeiture value policy under review. It also assumes that the policies remain in force for a specified period. If the policyholder purchased the theoretical term policy instead of the other, a premium savings accumulates over the ranking period. The Linton Yield method calculates the rate of interest necessary to equate this accumulation with the end period cash surrender value and termination dividend. This index ranks the policies with the higher yields as superior to the others.

All three systems have patent inadequacies. The traditional method allows front loaded policies to receive better than deserved rankings. Such contracts may defer cash value build up into later years of the ranking period or provide for a heavy termination dividend. Not only does the insurer obtain use of the policyholder's money for a longer time, it also achieves additional gains attributable to policy lapses during early years. All three systems fail to direct attention to the high cost of lapsing in early years. They illuminate only one point on a continuum, usually the tenth or twentieth year. Moreover, they take as a given fact the very thing that the policyholder seeks to insure — the continued long term survival of the insured.

A useful analysis should present information on a number of years rather than one or two arbitrarily selected. Policyholders entertain differing views on the cost of money. Accordingly, interest factors employed in an analysis should conform to the needs of the individual instead of incorporating an arbitrary rate. A useful analysis should permit meaningful comparisons among term, non-forfeiture value and financed insurance. It should also weigh all policy benefits, not just dividends and cash values, against costs. Subject to these criteria, the three common approaches prove unsatisfactory.

The Program

No one can truly evalute the cost of a life insurance contract until it lapses or the insured dies. At that time the analyst takes the policyholder's after-tax outlays, adjusted for the time value of money, and compares this amount to the after-tax receipts attributable to the policy, adjusted, as well, for the time value of money. This post hoc analysis translates to a practical, before-the-purchase analysis by substituting statistical expectations for hindsight quantities.

Use your computer to compare insurance contracts

The program listed combines statistical expectations, the time value of money and tax considerations to give the potential policyholder not only an index for comparing competing insurance contracts, but a means for rationally assessing the bet with and investment in the insurer. The program first computes the policyholder's anticipated return on the amount at risk for the year in question. For a term policy, the amount at risk equals the face value of the policy. For non-forfeiture value contracts, the amount at risk equals the face value reduced by the current cash surrender value. The anticipated return equals the product of the amount at risk and the force of mortality for the insured.

The force of mortality represents the actuarial probability of the insured's death in the year under review. For example, the mortality data used in the program assigns 156 chances of death out of 100,000 to a 30-year-old male. A policy with $100,000 at risk would, therefore, have a $156 anticipated return for the year in which the insured attained age 30. This data originated from the 1976 longevity report of the National Center for Health Statistics. Insurers frequently compile their own mortality tables from the experiences of their insureds. Such custom-made tables, presumably, measure both the insurers' abilities at screening substandard risks and the general force of mortality. However, they tend to lag behind the general advance in longevity, attributable to improvements in disease prevention and treatment. The NCHS table draws from a more general population. The use of neutral statistics should not discriminate between competing policies with distinct actuarial assumptions. You may wish to incorporate data for a sub-population more akin to the target insureds. The data array extends from age 30 to age 80. Redimensioning MM% and FM% (male and female force of mortality) would permit an enlarged range of ages.

For each year the algorithm adds net increases in cash values to the anticipated return on the risk amount and discounts the sum to reflect the time adjusted value of money. Since insurers disclose cash values in different ways, the program has two input modes. The "delta cash value" mode directly accepts the yearly change in cash value. The "current cash value" mode accepts the aggregate case value and employs a subroutine to compute the change. Term policies, of course, have no non-forfeiture values, and financed policies usually absorb the cash value increase by policy loans employed to pay premiums. You select the present value discount rate. The program refers to the discount rate as "the cost of money". Varying the rate can readily change the ranking of competing products in later years as well as the cumulative rankings. The sensitivity of rankings to changes in the discount rate reveals much. You should run the program for each policy several times with different discount factors.

In many situations the policy proceeds may fall into the insured's taxable estate. The federal estate tax scheme parallels the income tax in that it has a progressive tax rate rising to a maximum of 70%. You may incorporate the impact of the federal estate in the program for term and non-forfeiture value policies by substituting the net proceeds, after death taxes, for the face amount, when prompted. Making this adjustment for financed insurance plans requires some simple modifications.

The program also computes the discounted, after-tax cost of premium payments. You supply the policyholder's projected income tax rate. Arguments exist for inputing either the policyholder's effective tax rate or marginal tax rate. Consistency has more importance than the choice made. Financed insurance adds a complication. Interest paid on the policy loan adds to the cost. However, the policyholder should receive a corresponding tax deduction in the context of proper tax planning. Financed policies, therefore, combine a reducing anticipated return on the risk amount with a reducing net after-tax outlay for premiums and an increasing before-tax outlay for policy loan interest.

The financed insurance routine makes projections on the basis of cash value accumulation for the first four years of the policy's existence. It calls for the maximum policy loan in the fifth year and thereafter. Tax considerations constrain the policyholder from freely borrowing cash value during the four-out-of-seven period of a financed arrangement. Accordingly, during the four cash accumulation years the financed insurance routine treats the amount at risk as the face value of the policy and sets the actuarial value equal to the anticipated value of this amount. Use of this convention results in a large positive net value for the policy in the fifth year, corresponding to the lapse of the tax constraint and the availability of the accumulated cash value to the policyholder. You can modify the program to conform to some other four-out-of-seven pattern. Most users will find the convention adopted satisfactory. Typically, policies build cash value slowly in their early years so that the insurer may recover commissions and other front-end sales cost. By deferring the policy loans to a later time, the policyholder should minimize the funds held by the insurer.

The output gives you an analysis for each year for the period under study. The ranking of competing policies may switch from year to year. The program also displays a running cumulative net advantage or disadvantage. This number offers the best single index for policy comparison.

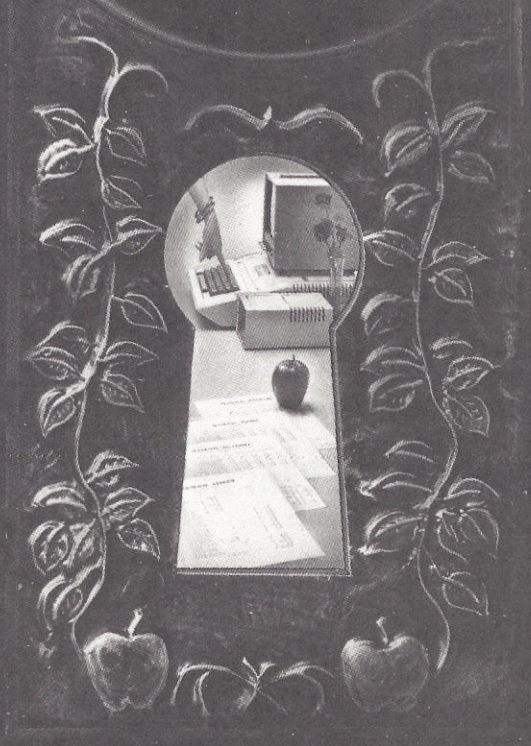
The program as listed runs on the TRS-80 with Level II Basic. With the possible exception of the "PRINT USING" format commands, you should have little trouble transposing to other Basic dialects. □

Program Listing

```
10  REM INSURANCE ANALYZER....FILE NAME "INSURE/BAS"
20    'BY
30    'EDWIN K.HUNTER
40    'CAMP,CARMOUCHE,PALMER, BARSH & HUNTER
50    'P.O. BOX 2001
60    'LAKE CHARLES, LOUISIANA, 70601
70  REM NCHS 1976 MALE MORTALITY RATE
80  DATA 156,158,162,168,176,186,199,215,235,257
90  DATA 283,313,346,385,427,475,527,582,641,704
100 DATA 774,850,932,1023,1121,1224,1337,1469,1625,1801
110 DATA 1994,2194,2396,2593,2791,2997,3234,3522,3830,4160
120 DATA 4420,4880,5194,5724,6183,6745,7191,7744,8331,8954,10028
130 REM NCHS 1976 FEMALE MORTALITY RATE
140 DATA 71,75,81,86,92,99,107,117,128,142
150 DATA 156,172,190,212,235,261,289,318,347,377
160 DATA 409,445,484,527,574,624,678,740,811,891
170 DATA 980,1074,1182,1240,1315,1394,1495,1668,1858,2066
180 DATA 2162,2542,2815,3111,3435,3758,4169,4545,5036,5524
190 DATA 6216
200 REM SPIN ARRAYS
210 DIM MM%(51),FM%(51)
220 FOR X%=0TO50
230     READ MM%(X%)
240 NEXT X%
250 FOR X%=0TO50
260     READ FM%(X%)
270 NEXT X%
280         '****** PROGRAM DRIVER ******
290 GOSUB 380  :  REM GENERAL INPUT
300 ON A1% GOSUB 490  ,600  ,750  :REM SPECIFIC INPUT
310 ON A1% GOSUB 970  ,1370 ,1800
320 INPUT"(1)MODIFY OR (2) TERMINATE. ENTER SELECTION";A2%
330 IF A2%=2 THEN END
340 CA$=0
350 INPUT "AVERAGE TAX BRACKET ON PREMIUM AS A PERCENT";TB%
360 INPUT "COST OF MONEY AS A DECIMAL FRACTION";CM!
370 GOTO 310
380         '****** GENERAL INPUT ******
390 INPUT"(1)TERM,(2)NON-FORFEITURE,(3)MINIMUM DEPOSIT";A1%
400 INPUT"FACE VALUE OF POLICY";FV$
410 INPUT"INSURED'S GENDER(F/M)";S$
420 INPUT "COST OF MONEY AS A DECIMAL FRACTION";CM!
430 INPUT "INSURED'S AGE";IA%
440 INPUT "NUMBER OF YEARS TO BE PROJECTED";NY%
450 DIM AP!(NY%)
460 IF IA%+NY%>80 THEN NY%=80-IA%
470 INPUT "AVERAGE TAX BURDEN ON PREMIUM AS A PERCENT";TB%
480 RETURN
490         '****** TERM INPUT ******
500 INPUT"(1)FIXED OR (2) VARIABLE PREMIUM.ENTER SELECTION";P%
510 IF P%=1 THEN INPUT"ANNUAL PREMIUM";FP!
520 FOR X%=0TONY%-1
530   PRINT "INSURED'S AGE ";IA%+X%
540   INPUT "CURRENT DIVIDEND";D$
550   IF P%=2 THEN INPUT "PREMIUM";AP!
560   IF P%=1 THEN AP!=FP!
570   AP!(X%)=AP!-D$
1210 CV$=0
1220 LPRINT " "
1230 LPRINT " ","DISCOUNTED","CUMULATIVE DISCOUNTED"
1240 LPRINT "AGE","ADVANTAGE","ADVANTAGE"
1250 FOR X%=0TONY%-1
1260    Z%=IA%-30+X%
1270    IF S$="M" THEN AV$=FV$*MM%(Z%)/100000
1280    IF S$="F" THEN AV$=FV$*FM%(Z%)/100000
1290    DF!=1/(1+CM!)[X%
1300    NV$=AV$*DF!-DF!*(AP!(X%)/(1-TB%/100))
1310    CA$=CA$+NV$
1320    LPRINT IA%+X%,
1330   U$="$$###,####.       $$###,####."
1340   LPRINT USING U$;NV$,CA$
1350 NEXT X%
1360 RETURN
1370         '******NON-FORFEITURE OUTPUT******
1380 LPRINT"                        NON-FORFEITURE INSURANCE ANALYSIS"
1390 LPRINT"ENTRY AGE........."IA%
1400 LPRINT"INSURED'S GENDER.."
1410 IF S$="M" LPRINT "MALE"
1420 IF S$="F" LPRINT "FEMALE"
1430 LPRINT"FACE VALUE OF POLICY...."FV$
1440 LPRINT"AVERAGE TAX BRACKET...."TB%"%"
1450 LPRINT"COST OF MONEY...."CM!*100"%"
1460 LPRINT" "
1470 LPRINT" "
1480 LPRINT" ","AFTER TAX","DISCOUNTED","DISCOUNTED"
1490 LPRINT"AGE","PREMIUM COST","ACTUARIAL VALUE","NET VALUE(COST)"
1500 FOR X%=0TONY%-1
1510    NF$=NF$+CV$(X%)
1520    Z%=IA%-30+X%
1530    IF S$="M" THEN AV$=CV$(X%)+(FV$-NF$)*MM%(Z%)/100000
1540    IF S$="F" THEN AV$=CV$(X%)+(FV$-NF$)*FM%(Z%)/100000
1550    DF!=1/(1+CM!)[X%
1560    NV$=AV$*DF!-DF!*(AP!(X%)/(1-TB%/100))
1570    LPRINT IA%+X%,
1580    U$="$$###,####.    $$###,####.    $$###,####."
1590    LPRINT USING U$;AP!(X%)/(1-TB%/100),AV$*DF!,NV$
1600 NEXT X%
1610 LPRINT"*   *   *   *   *   *   *   *   *   *"
1620 LPRINT" "
1630 LPRINT" "
1640 NF$=0
1650 LPRINT" ","DISCOUNTED","CUMULATIVE DISCOUNTED"
1660 LPRINT"AGE","NET VALUE(COST)","NET VALUE(COST)"
1670 FOR X%=0TONY%-1
1680    NF$=NF$+CV$(X%)
1690    Z%=IA%-30+X%
1700    IF S$="M" THEN AV$=CV$(X%)+(FV$-NF$)*MM%(Z%)/100000
1710    IF S$="F" THEN AV$=CV$(X%)+(FV$-NF$)*FM%(Z%)/100000
1720    DF!=1/(1+CM!)[X%
1730    NV$=AV$*DF!-DF!*(AP!(X%)/(1-TB%/100))
1740    CA$=CA$+NV$
1750    LPRINT IA%+X%,
1760    U$="$$###,####.      $$###,####."
1770    LPRINT USING U$;NV$,CA$
1780 NEXT X%
1790 RETURN
1800          '****** FINANCED INSURANCE OUTPUT******
1810 LPRINT"                    FINANCED INSURANCE ANALYSIS"
1820 LPRINT"ENTRY AGE........."IA%
1830 LPRINT"INSURED'S GENDER.."
```

```
580 NEXT X%
590 RETURN
600         '****** NON-FORFEITURE INPUT ******
610 DIM CV$(NY%)
620 INPUT"(1)DELTA CASH VALUE OR (2) ANNUAL CASH VALUE";C%
630 INPUT"(1)FIXED PREMIUM OR (2) VARIABLE PREMIUM";P%
640 IF P%=1 THEN INPUT "ANNUAL PREMIUM";FP!
650 FOR X%=0TONY%-1
660    PRINT "INSURED'S AGE ";IA%+X%
670    IF P%=1 THEN AP!(X%)=FP!
680    IF P%=2 THEN INPUT "PREMIUM";AP!(X%)
690    IF C%=1 THEN INPUT "CASH VALUE INCREASE";CV$
700    IF C%=2 THEN GOSUB 920
710    INPUT "CURRENT DIVIDEND";D$
720    CV$(X%)=CV$+D$
730 NEXT X%
740 RETURN
750         '****** FINANCED INSURANCE INPUT******
760 DIM CV$(NY%)
770 INPUT "(1)DELTA CASH VALUE OR (2) ANNUAL CASH VALUE";C%
780 INPUT "(1)FIXED PREMIUM OR (2) VARIABLE PREMIUM";P%
790 IF P%=1 THEN INPUT "ANNUAL PREMIUM";FP!
800 INPUT "POLICY LOAN INTEREST RATE AS A DECIMAL FRACTION";PL!
810 FOR X%=0TONY%-1
820    PRINT "INSURED'S AGE ";IA%+X%
830    INPUT "CURRENT DIVIDEND";D$
840    IF P%=2 THEN INPUT "PREMIUM";AP!
850    IF P%=2 THEN AP!(X%)=AP!-D$
860    IF P%=1 THEN AP!(X%)=FP!-D$
870    IF C%=1 THEN INPUT "CASH VALUE INCREASE";CV$
880    IF C%=2 THEN GOSUB 920
890    CV$(X%)=CV$
900 NEXT X%
910 RETURN
920         '******DELTA CV SUBROUTINE******
930 INPUT "CURRENT CASH VALUE";CC$
940 CV$=CC$-LC$
950 LC$=CC$
960 RETURN
970         '****** TERM OUTPUT ******
980 LPRINT"                          TERM INSURANCE ANALYSIS"
990 LPRINT"ENTRY AGE.........";IA%
1000 LPRINT"INSURED'S GENDER..";
1010 IF S$="M" LPRINT "MALE"
1020 IF S$="F" LPRINT "FEMALE"
1030 LPRINT"FACE VALUE OF POLICY....";FV$
1040 LPRINT"AVERAGE TAX BRACKET....";TB%;"%"
1050 LPRINT"COST OF MONEY....";CM!*100;"%"
1060 LPRINT" "
1070 LPRINT" "
1080 LPRINT "  ","AFTER TAX","DISCOUNTED","DISCOUNTED""
1090 LPRINT "AGE","PREMIUM COST","ACTUARIAL VALUE","NET VALUE(COST)"
1100 FOR X%=0TONY%-1
1110    Z%=IA%-30+X%
1120    IF S$="M" THEN AV$=FV$*MM%(Z%)/100000
1130    IF S$="F" THEN AV$=FV$*FM%(Z%)/100000
1140    DF!=1/(1+CM!)[X%
1150    NV$=AV$*DF!-DF!*(AP!(X%)/(1-TB%/100))
1160    LPRINT IA%+X%,
1170    U$="$$###,####.     $$###,####.    $$###,####."
1180    LPRINT USING U$;AP!(X%)/(1-TB%/100),AV$*DF!,NV$
1190 NEXT X%
1200 LPRINT"*   *   *   *   *   *   *   *   *   *"
1840 IF S$="M" LPRINT "MALE"
1850 IF S$="F" LPRINT"FEMALE"
1860 LPRINT"FACE VALUE OF POLICY....";FV$
1870 LPRINT"AVERAGE TAX BRACKET....";TB%;"%"
1880 LPRINT"COST OF MONEY....";CM!*100;"%"
1890 LPRINT" "
1900 LPRINT" "
1910 LPRINT" ","AFTER TAX","DISCOUNTED","DISCOUNTED"
1920 LPRINT"AGE","NET PREMIUM","ACTUARIAL VALUE","NET VALUE(COST)
1930 FOR X%=0TONY%-1
1940    Z%=IA%-30+X%
1950    NF$=NF$+CV$(X%)
1960    DF!=1/(1+CM!)[X%
1970    IF X%>5 THEN GOSUB 2220
1980    IF X%=5 THEN GOSUB 2270
1990    IF X%<=4 THEN GOSUB 2330
2000    LPRINT IA%+X%,
2010    U$="$$###,####.     $$###,####.      $$###,####."
2020    LPRINT USING U$;NF$,DF!*AV$,NV$
2030 NEXT X%
2040 LPRINT"*   *   *   *   *   *   *   *   *   *"
2050 LPRINT" ","DISCOUNTED","CUMULATIVE DISCOUNTED"
2060 LPRINT"AGE","ADVANTAGE","ADVANTAGE"
2070 NF$=0
2080 FOR X%=0TONY%-1
2090    NF$=NF$+CV$(X%)
2100    Z%=IA%-30+X%
2110    DF!=1/(1+CM!)[X%
2120    IF X%>5 THEN GOSUB 2220
2130    IF X%=5 THEN GOSUB 2270
2140    IF X%<=4 THEN GOSUB 2330
2150    CA$=CA$+NV$
2160    LPRINT IA%+X%,
2170    U$="$$###,####.      $$###,#####."
2180    LPRINT USING U$; NV$,CA$
2190 NEXT X%
2200 RETURN
2210          '******MINIMUM DEPOSIT CYCLE******
2220    IF S$="M" THEN AV$=(FV$-NF$)*MM%(Z%)/100000
2230    IF S$="F" THEN AV$=(FV$-NF$)*FM%(Z%)/100000
2240    NP$=(AP!(X%)-CV$(X%))/(1-TB%/100)+NF$*PL!
2250    NV$=DF!*(AV$-NP$)
2260    RETURN
2270          '******FIFTH YEAR******
2280    IF S$="M" THEN AV$=(FV$-NF$)*MM%(Z%)/100000
2290    IF S$="F" THEN AV$=(FV$-NF$)*FM%(Z%)/100000
2300    NP$=AP!(X%)/(1-TB%/100)
2310    NV$=DF!*(AV$+NF$-NP$)
2320    RETURN
2330          '******ACCUMULATION CYCLE******
2340    IF S$="M" THEN AV$=FV$*MM%(Z%)/100000
2350    IF S$="F" THEN AV$=FV$*FM%(Z%)/100000
2360    NP$=AP!(X%)/(1-TB%/100)
2370    NV$=DF!*(AV$-NP$)
2380    RETURN
2390         '******KEY VARIABLE TABLE******
2400 'FV$=POLICY FACE VALUE, CM!=COST OF MONEY, AP!=PREMIUM
2410 'TB%/100=POLICYHOLDER'S INCOME TAX BRACKET,D$=DIVIDEND
2420 'CV$=CASH VALUE INCREASE, CA$=CUMULATIVE (DIS)ADVANTAGE
2430 'DF!=DISCOUNT TO PRESENT VALUE FACTOR,NV$=NET VALUE, NP$=NET PREMIUM
2440 'AV$=ACTUARIAL VALUE OF DEATH BENEFIT,PL!=POLICY LOAN INTEREST RATE
2450 'NF$=POLICY LOAD BALANCE; MM%(Z%)/100000=MALE FORCE OF MORTALITY
2460 'FM%(Z%)/100000=FEMALE FORCE OF MORTALITY
```

It's Almost Obscene...



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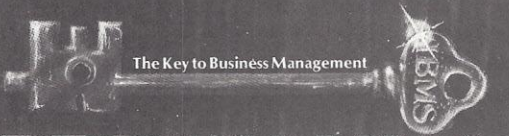

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CIRCLE 16

Where Does It All Go?

BY RAY VUKCEVICH

Planned spending means having enough money to buy the things you really want to have, and having enough money for the things you absolutely *must* have (minor amenities such as rent, car insurance, medical care, etc.). Planned spending means never having to don a false moustache and beard to avoid the bill collectors every time you step out of the house. Planned spending means operating under a budget, hence the program I am about to describe.

This is a program intended for use by small businesses and individuals who require assistance in making ends meet. It will not balance your checkbook or calculate your taxes. Use a pocket calculator for the former and a tax expert for the latter. The program *will* allow the user to formulate a budget and then utilize a "what-if" approach to balance it. A spendig history is kept in order to allow for realistic planning for successive budgets over a period of months. In brief, the goal is to seize control of the purse strings, and manipulate them in the manner of a master puppeteer.

Mr. Vukcevich is a freelance writer and investor who resides in Arizona with his teenage son.

BUDGET is a very flexible program. You can try a number of spending strategies, add and delete categories, calcultor routine. Remember that changing one factor will change all related factors. Budgets can be saved on disk or discarded. The idea is to keep working with your budget until you come up with something you can live with.

When the program is run, the following menu is presented:

E - ESTABLISH PARAMETERS
C - CHANGE PARAMETERS

S - SEE BUDGET
W - WRITE FILE TO DISK
R - READ OLD FILE FROM DISK

A - ADJUST FOR SPENDING
Q - QUIT

TASK?

Sample Run

```
Budget estimate for SEPTEMBER

     Fixed                Variable              Other
     -----                --------              -----
     RENT        350.00   FOOD        200.00   SAV          35.00
     LOAN         90.00   GAS          50.00   MISC        100.00
                   0.00   ELEC         50.00   MEDICAL      50.00
                   0.00   PHONE        30.00   INSUR        35.00
                   0.00   MAS CRG      70.00                 0.00
                   0.00   AM EXP       65.00                 0.00
                   0.00   GASOLINE     75.00                 0.00
                --------              --------             --------
     Totals      440.00                540.00               220.00

     Income                          $1,200.00
     Estimated expenses              $1,200.00
                                    ----------
     Balanced                            $0.00
```

Spending categories and amounts must first be established. When the E command is used, the program first asks for the month. Comments may be included here. For example, "AUGUST — with paycheck #2 but not dividend check." Or, if you don't want to budget by month, a time period may be used. An example is "9/11 to 10/15." Next, the program requests your income for the month or period. Here you can get a calculator routine by typing CALC. In fact, you can get the calculator routine almost any time numeric data is requested. Once your income is entered, the program asks you to consider your fixed expenses. These are the items you pay every month which are always in the same amount. Rent and loan payments are examples of fixed expenses. Hit RETURN when all fixed expenses have been entered, and the program will move on to month but which are not always the same amount. Food and electricity are examples. Finally, the program will ask for your other expenses. You should enter all expenses which don't fit in the first two categories. Entertainment and medical costs might go here. Hit RETURN and the program will display the budget as you have entered it. If it is balanced, you will be told; and if your expenses are greater than your income, you can see how much you have to cut. You may print the budget at this time. You can get hard copy whenever a budget sheet is displayed on the CRT.

If your expenses are greater than your income, you will want to make changes. The C command will display the old month, income and names and amounts in each category. The program will ask you if you want to change any of the fixed expenses. For example:

```
RENT          350
LOAN           90
Change FIXED expenses?
```

Three responses are possible. You may type ADD and add a new fixed expense; you may type Y or YES and make changes; or you may hit RETURN and the program will go on to the variable expenses. If you type Y, you may also delete an expense by typing DEL. Anytime you do not wish a change, hit RETURN and the old values will be retained.

Change the variable and other expenses in the same way. After you have finished with the other expenses, the budget sheet will be displayed. If you have still not achieved a balanced budget, you may use the C command again. If the budget is balanced, you can use the W command to write it to disk. When the W command is called, you are asked for a file name. Should you type W by mistake, or if you change your mind, hit RETURN, and the program will return to the menu. If you are going to use both budget and spending files (see the A command below), it is important to differentiate between the two. For example, use AUGUST.BUD for your budget file and AUGUST.SPD for your spending file. The program writes over old files of the same name, so watch your file names!

planned spending means never having to say "I wish I could afford it right now."

After entering a budget or reading one from disk, you can use the S command whenever you're at the main menu to see the budget sheet.

The R command is used to read a file from disk. Hit RETURN if you change your mind and do not want to read a file after all.

The first step in using the spending routine is to read a file from disk, using the R command. If you do not yet have a spending file, use the budget file. For example, suppose you have formulated a budget for August and have called it AUGUST.BUD. Now you want to adjust for spending. First, use the R command and read AUGUST.BUD. Then use the A command. The fixed expenses will be displayed. If you have spend here, answer Y or YES to the question "Change FIXED expenses?" Then type the amount you spent. Hit RETURN for any category in which you spent nothng. BUDGET will do the arithmetic.

EXAMPLE:

```
RENT
  350
Amount Spent? [RETURN]

LOAN
  90
Amount Spent? 89.5
```

When you finish entering data for fixed, variable and other expenses, a budget sheet will be displayed showing how much you must or may still spend in each category. You can print the sheet or go on. Hitting return will produce the question "See History?" If you answer Y or YES, what you have spend to date in each category will be displayed. You many print this too. Next, the program will ask: "Write spending file?" If Y or YES is your response, the program will ask you to name the spending file. In this example, you should answer: AUGUST.SPD. The program will now write the spendig file. The next time spending is to be adjusted, use the R command to read AUGUST.SPD.

You can call the calculator routine almost anytime numeric data is requested. To add values, simple type them one after another. To get the result, hit RETURN. When finished, answer Y or YES. To clear the result, use C. Change the operator by typing it before the number. Here's an example:

```
Number? 5
Number? *5
Number? [RETURN]
25
Finished? [RETURN]

Number? C
```

You can add (+), subtract (—), divide (/), and multiply (*). Notice also that you may use ";" for add, ":" for multiply, "?" for divide, and "=" for subtract. These are the other characters on the operator keys ("+" and ";" on one key for example). You may have to change these if your keyboard is different. This arrangement was used to avoid having to use the shift key when calculating.

BUDGET is written in CBASIC-2 and should be easy to convert to other BASICS. Here are a few things to consider:

Line numbers are necessary in C-BASIC only as labels for branching destinaions — that is, the places where goto and gosub statements send control. See lines 19 and 45 for examples. The line numbers which appear occasionally to the immediate right of the regular line listings are compiler-generated, and were not typed in when the program was written.

Three types of variables are used in the program. FIXED$ is an example of the type String. F/ is an example of the type Integer, and FIXED is an example of the type Real. Be careful with subscripted variables. FIXED and FIXED (X/) are different!

Note the use of CHR$ in lines 5 through 8. CHR$ (126) +CHR$ (28) clears the screen and homes the cursor on a Hazeltine 1500. CHR$ (126) +CHR$ (31) causes the Hazeltine to display highlighted characters, and CHR$ (126) +CHR$ (25) returns the display to normal. Use your own terminal's codes.

CBASIC allows long variables (FORM.FEED$ for example). You may need to make substitutions in your BASIC. Also note the use of "/" in line 344. The back slash indicates to the CBASIC compiler that the line is to be continued.

The variable MAX/ in compiler line 10 controls the maximum number of subcategories in each of the major categories; fixed, variable and other. Change this number to suit your needs.

The display routine (starting in CBASIC line 300 and compiler line 144) is written for an 80 column screen. If you're using an APPLE, for example, you will have to redesign the display to fit your screen.

BUDGET is a tool for taking control of your finances. The program is fairly large, and includes many features designed for ease of use. The more that the program is used, the more you will find your own working methods suggesting possible modifications to fit your own personal style of accounting for the weekly paycheck's dispersal. One of the obvious benefits of utilizing BUDGET for tracking finances is that when tax time rolls, around, all of the major expenses that usually qualify for the deductions are already on file in the disk. □

Program Listing

```
 1: REM THIS PROGRAM HELPS YOU FORMULATE A BUDGET
 2: REM AND KEEP TRACK OF YOUR SPENDING.
 3: REM BY RAY VUKCEVICH
 4: REM     CL$ IS CLEAR SCREEN. BR$ IS BRIGHT. DM$ IS DIM.
 5:         CL$=CHR$(126)+CHR$(28)
 6:         BR$=CHR$(126)+CHR$(31)
 7:         DM$=CHR$(126)+CHR$(25)
 8:         FORM.FEED$=CHR$(12)
 9:         MENU$="ECSWRAQ"
10:         MAX%=10
11:         NO.DOL$="#,###.##"
12:         DOL$="$$#,###.##"
13:         DIM FIXED$(MAX%),VAR$(MAX%),OTHER$(MAX%)
14:         DIM FIXED(MAX%),VAR(MAX%),OTHER(MAX%)
15:         DIM SPENT.FIXED(MAX%),SPENT.VAR(MAX%),SPENT.OTHER(MAX%)
16:         DIM HOLD.FIXED(MAX%),HOLD.VAR(MAX%),HOLD.OTHER(MAX%)
17: REM GET MENU SELECTION
18: 10      GOSUB 20
19:         ON T% GOSUB 100,200,300,400,500,600,700
20:         GOTO 10
21: REM DISPLAY MENU
22: 20      PRINT CL$
23:         PRINT TAB(10);"Budget"
24:         PRINT TAB(10);"------"
25: REM ERROR MESSAGE AREA
26:         IF ERSW% THEN ERSW%=0:PRINT TAB(10);BR$;"No File";DM$:PRINT
27:                 PRINT TAB(10);"E - ESTABLISH PARAMETERS"
28:                 PRINT TAB(10);"C - CHANGE PARAMETERS"
29:                 PRINT
30:                 PRINT TAB(10);"S - SEE BUDGET"
31:                 PRINT TAB(10);"W - WRITE FILE TO DISK"
32:                 PRINT TAB(10);"R - READ OLD FILE FROM DISK"
33:                 PRINT
34:                 PRINT TAB(10);"A - ADJUST FOR SPENDING"
35:                 PRINT
36:                 PRINT TAB(10);"Q - QUIT"
37:                 PRINT:PRINT
38:                 INPUT "Task?";T$
39:                 T$=LEFT$(T$,1)
40:         FOR T%=1 TO 7
41:                 IF T$=MID$(MENU$,T%,1) THEN RETURN
42:         NEXT T%
43:                         GOTO 10
44: REM ESTABLISH PARAMETERS
45: 100             PRINT CL$
46:                 GOSUB 1400
47:                 INPUT "Month?";LINE MON$
48: REM RETURN POINT FOR CALC ROUTINE
49: 110     PRINT:PRINT "Type CALC below for a calculator routine."
50:         PRINT:PRINT "Income for ";MON$;
51:         INPUT LINE INCOME$
52:         IF INCOME$="CALC" THEN GOSUB 1800:GOTO 110
53:         INCOME=VAL(INCOME$)
54:         SPENT.INCOME=INCOME
55: REM FIXED EXPENSES
56:         PRINT CL$
57:         PRINT
58:         PRINT "Consider the FIXED EXPENSES paid every month."
59:         PRINT
60:                 GOSUB 1000
61: REM VARIABLE EXPENSES
62:         PRINT CL$
63:         PRINT
64:         PRINT "Now made a top estimate of those expenses you pay"
65:         PRINT "every month which are NOT ALWAY THE SAME AMOUNT."
66:         PRINT
67:                 GOSUB 1100
68: REM OTHER EXPENSES
69:         PRINT CL$
70:         PRINT
71:         PRINT "Finally make realistic extimates of the OTHER expenses"
72:         PRINT "which will not fit in the first two categories."
73:         PRINT
74:                 GOSUB 1200
75: REM GET RESULTS AND DISPLAY
76:                 GOSUB 1300
77:                 GOSUB 300
78:                                         RETURN
79: REM CHANGE PARAMETERS
80: 200     PRINT CL$
81:         PRINT "Use RETURN to retain old values."
82:         PRINT
83:         PRINT MON$
84:         INPUT "New Month?";LINE NM$
85:         PRINT
86:         IF NM$="" THEN 210
87:         MON$=NM$
88: 210     PRINT INCOME
89:         INPUT "New Income?";LINE NI$
90:         PRINT
91:         IF NI$="CALC" THEN GOSUB 1800:GOTO 210
92:         IF NI$="" THEN 220
93:         INCOME=VAL(NI$)
94:         SPENT.INCOME=INCOME
95: 220             FOR X%=1 TO F%
96:                         PRINT FIXED$(X%),FIXED(X%)
97:                 NEXT X%
98:         INPUT "Change FIXED expenses?";LINE Q$
99:         PRINT
100:        IF LEFT$(Q$,1)="Y" THEN GOSUB 1500:GOTO 230
101:        IF Q$<>"ADD" THEN 230
102:                GOSUB 260
103:                IF ITEM$="" THEN 220
104:                F%=F%+1
105:                FIXED$(F%)=ITEM$:FIXED(F%)=AMOUNT
106:                FIXED=FIXED+FIXED(F%)
107:                        GOTO 220
108: 230            FOR X%=1 TO V%
109:                        PRINT VAR$(X%),VAR(X%)
110:                NEXT X%
111:        INPUT "Change VARIABLE expenses?";LINE Q$
112:        PRINT
113:        IF LEFT$(Q$,1)="Y" THEN GOSUB 1600:GOTO 240
114:        IF Q$<>"ADD" THEN 240
115:                GOSUB 260
116:                IF ITEM$="" THEN 230
117:                V%=V%+1
118:                VAR$(V%)=ITEM$:VAR(V%)=AMOUNT
119:                VAR=VAR+VAR(V%)
120:                        GOTO 230
121: 240            FOR X%=1 TO O%
122:                        PRINT OTHER$(X%),OTHER(X%)
123:                NEXT X%
124:        INPUT "Change OTHER expenses?";LINE Q$
125:        PRINT
126:        IF LEFT$(Q$,1)="Y" THEN GOSUB 1700:GOTO 250
127:        IF Q$<>"ADD" THEN 250
128:                GOSUB 260
129:                IF ITEM$="" THEN 240
130:                O%=O%+1
131:                OTHER$(O%)=ITEM$:OTHER(O%)=AMOUNT
132:                OTHER=OTHER+OTHER(O%)
133:                        GOTO 240
134: 250    IF INCOME<0 THEN INCOME=0
135:                GOSUB 1300
136:                GOSUB 300
137:                                        RETURN
138: 260    PRINT CL$
139:        INPUT "New Item?";LINE ITEM$
140:        IF ITEM$="" THEN RETURN
141:        INPUT "New Amount?";AMOUNT
142:                                        RETURN
143: REM SEE BUDGET
144: 300    NUM%=F%
145:        IF V%>NUM% THEN NUM%=V%
146:        IF O%>NUM% THEN NUM%=O%
147:        PRINT CL$
148: REM START PRINT
149: 310    PRINT:PRINT
150:        PRINT TAB(5);"Budget estimate for ";MON$
151:        PRINT:PRINT
152:        PRINT TAB(10);"Fixed";TAB(30);"Variable";TAB(50);"Other"
153:        PRINT TAB(10);"-----";TAB(30);"--------";TAB(50);"-----"
154:                FOR X%=1 TO NUM%
155:        PRINT TAB(10);FIXED$(X%);TAB(20);
156:        PRINT USING NO.DOL$;FIXED(X%);
157:        PRINT TAB(30);VAR$(X%);TAB(40);
158:        PRINT USING NO.DOL$;VAR(X%);
159:        PRINT TAB(50);OTHER$(X%);TAB(60);
160:        PRINT USING NO.DOL$;OTHER(X%)
161:                NEXT X%
162:        PRINT TAB(20);"--------";TAB(40);"--------";TAB(60);"--------"
163:        PRINT TAB(10);"Totals";TAB(20);
164:        PRINT USING NO.DOL$;FIXED;TAB(40);
165:        PRINT USING NO.DOL$;VAR;TAB(60);
166:        PRINT USING NO.DOL$;OTHER
167:        PRINT
168:        PRINT TAB(10);"Income";TAB(40);
169:        PRINT USING DOL$;INCOME
170:        PRINT TAB(10);"Estimated expenses";TAB(40);
171:        PRINT USING DOL$;TOTAL
172:        PRINT TAB(40);"----------"
173:        IF INCOME>=TOTAL AND TOTAL>=0 THEN PRINT TAB(10);\
174:                "Balanced";TAB(40);:PRINT USING DOL$;INCOME.HI
175:        IF INCOME<TOTAL OR TOTAL<0 THEN PRINT TAB(10);\
176:                "OVER by";TAB(40);:PRINT USING DOL$;TOTAL.HI
177:        IF LEFT$(PRIN$,1)="Y" THEN PRINT FORM.FEED$:CONSOLE
178:        PRINT
179:        INPUT "Print?";LINE PRIN$
180:        IF LEFT$(PRIN$,1)="Y" THEN LPRINTER:GOTO 310
181:                                            RETURN
182: REM WRITE FILE TO DISK
183: 400    PRINT CL$
184:        INPUT "File Name (write)?";LINE FL$
185:        IF FL$="" THEN RETURN
186:                READ%=0
187:                GOSUB 1900
188: REM WRITE FIRST REC
189:        PRINT #1;MON$,INCOME,F%,V%,O%,SPENT.INCOME
190: REM FIXED
191:        FOR X%=1 TO F%
192:                PRINT #1;FIXED$(X%),FIXED(X%),SPENT.FIXED(X%)
193:        NEXT X%
194: REM VARIABLE
195:        FOR X%=1 TO V%
196:                PRINT #1;VAR$(X%),VAR(X%),SPENT.VAR(X%)
197:        NEXT X%
198: REM OTHER
199:        FOR X%=1 TO O%
200:                PRINT #1;OTHER$(X%),OTHER(X%),SPENT.OTHER(X%)
201:        NEXT X%
202: REM FINISHED
203:                CLOSE 1
204:                                        RETURN
205: REM READ FILE
206: 500    PRINT CL$
207:        INPUT "File Name (read)?";LINE FL$
208:        IF FL$="" THEN RETURN
209:                GOSUB 1400
210:                READ%=1
211:                GOSUB 1900
212:        IF OLD.FILE%=0 THEN ERSW%=1:RETURN
213:                GOSUB 1400
214: REM READ FIRST REC
215:        READ #1;MON$,INCOME,F%,V%,O%,SPENT.INCOME
216: REM READ FIXED
217:        FOR X%=1 TO F%
218:                READ #1;FIXED$(X%),FIXED(X%),SPENT.FIXED(X%)
219:                SPENT.FIXED=SPENT.FIXED+SPENT.FIXED(X%)
220:                FIXED=FIXED+FIXED(X%)
221:        NEXT X%
222: REM READ VARIABLE
223:        FOR X%=1 TO V%
224:                READ #1;VAR$(X%),VAR(X%),SPENT.VAR(X%)
225:                SPENT.VAR=SPENT.VAR+SPENT.VAR(X%)
226:                VAR=VAR+VAR(X%)
227:        NEXT X%
228: REM READ OTHER
229:        FOR X%=1 TO O%
230:                READ #1;OTHER$(X%),OTHER(X%),SPENT.OTHER(X%)
231:                SPENT.OTHER=SPENT.OTHER+SPENT.OTHER(X%)
232:                OTHER=OTHER+OTHER(X%)
233:        NEXT X%
234: REM FINISHED
235:                CLOSE 1
236:                READ%=0
237:                GOSUB 1300
238:                                        RETURN
239: REM ADJUST FOR SPENDING
240: 600    PRINT CL$
```

continued

Program Listing

```
241:                ADJ%=1
242:                HOLD.MON$=MON$
243:                HEAD$=" (remaining)"
244:                MON$=HOLD.MON$+HEAD$
245:                GOSUB 220
246:                PRINT CL$
247:          INPUT "See History?";LINE Q$
248:          IF LEFT$(Q$,1)="Y" THEN GOSUB 610
249:                PRINT CL$
250:                MON$=HOLD.MON$
251:          INPUT "Write spending file?";LINE Q$
252:          IF LEFT$(Q$,1)="Y" THEN GOSUB 400
253:                ADJ%=0
254:                                          RETURN
255: REM SEE HISTORY
256: 610      FOR X%=1 TO MAX%
257:                HOLD.FIXED(X%)=FIXED(X%)
258:                FIXED(X%)=SPENT.FIXED(X%)
259:                HOLD.VAR(X%)=VAR(X%)
260:                VAR(X%)=SPENT.VAR(X%)
261:                HOLD.OTHER(X%)=OTHER(X%)
262:                OTHER(X%)=SPENT.OTHER(X%)
263:          NEXT X%
264:          HEAD$=" (to date)"
265:          MON$=HOLD.MON$+HEAD$
266:          HOLD.INCOME=INCOME
267:          INCOME=SPENT.INCOME
268:          HOLD.FIXED=FIXED:HOLD.VAR=VAR:HOLD.OTHER=OTHER
269:          FIXED=SPENT.FIXED:VAR=SPENT.VAR:OTHER=SPENT.OTHER
270:                GOSUB 1300
271:                GOSUB 300
272:          INCOME=HOLD.INCOME
273:          FIXED=HOLD.FIXED:VAR=HOLD.VAR:OTHER=HOLD.OTHER
274:          FOR X%=1 TO MAX%
275:                FIXED(X%)=HOLD.FIXED(X%)
276:                VAR(X%)=HOLD.VAR(X%)
277:                OTHER(X%)=HOLD.OTHER(X%)
278:          NEXT X%
279:                GOSUB 1300
280:                                          RETURN
281: REM QUIT
282: 700                                      STOP
283: REM INPUT FIXED
284: 1000     FOR X%=1 TO MAX%
285:                PRINT "Item #";X%;
286:                INPUT LINE FIXED$(X%)
287:                IF FIXED$(X%)="" THEN 1010
288:                INPUT "Amount?";FIXED(X%)
289:                FIXED=FIXED+FIXED(X%)
290:                PRINT
291:          NEXT X%
292: 1010     F%=X%-1
293:                                          RETURN
294: REM INPUT VAR
295: 1100     FOR X%=1 TO MAX%
296:                PRINT "Item #";X%;
297:                INPUT LINE VAR$(X%)
298:                IF VAR$(X%)="" THEN 1110
299:                INPUT "Amount?";VAR(X%)
300:                VAR=VAR+VAR(X%)
301:                PRINT
302:          NEXT X%
303: 1110     V%=X%-1
304:                                          RETURN
305: REM INPUT OTHER
306: 1200     FOR X%=1 TO MAX%
307:                PRINT "Item #";X%;
308:                INPUT LINE OTHER$(X%)
309:                IF OTHER$(X%)="" THEN 1210
310:                INPUT "Amount?";OTHER(X%)
311:                OTHER=OTHER+OTHER(X%)
312:                PRINT
313:          NEXT X%
314: 1210     O%=X%-1
315:                                          RETURN
316: REM GET TOTALS
317: 1300     TOTAL=FIXED+VAR+OTHER
318:          INCOME.HI=INCOME-TOTAL
319:          TOTAL.HI=TOTAL-INCOME
320:                                          RETURN
321: REM ZERO COUNTERS
322: 1400     FIXED=0:VAR=0:OTHER=0:TOTAL=0:INCOME=0
323:          SPENT.FIXED=0:SPENT.VAR=0:SPENT.OTHER=0:SPENT.INCOME=0
324:          F%=0:V%=0:O%=0
325:          FOR X%=1 TO MAX%
326:                FIXED$(X%)="":VAR$(X%)="":OTHER$(X%)=""
327:                FIXED(X%)=0:VAR(X%)=0:OTHER(X%)=0
328:                SPENT.FIXED(X%)=0:SPENT.VAR(X%)=0:SPENT.OTHER(X%)=0
329:          NEXT X%
330:                                          RETURN
331: REM RESET FIXED DATA
332: 1500     PRINT CL$
333:          FIXED=0
334:          SPENT.FIXED=0
335:          FOR X%=1 TO F%
336: REM RETURN POINT FOR CALC
337: 1505           PRINT FIXED$(X%)
338:                PRINT FIXED(X%)
339:                IF ADJ% THEN PRINT "Amount Spent"; ELSE \
340:                                PRINT "New Amount";
341:                INPUT LINE NA$
342:                PRINT
343:                IF NA$="CALC" THEN GOSUB 1800:GOTO 1505
344:                IF ADJ% THEN INCOME=INCOME-VAL(NA$):\
345:                           FIXED(X%)=FIXED(X%)-VAL(NA$):\
346:                           SPENT.FIXED(X%)=SPENT.FIXED(X%)+VAL(NA$):\
347:                           SPENT.FIXED=SPENT.FIXED+SPENT.FIXED(X%):\
348:                                GOTO 1510
349:                IF NA$="" THEN 1510
350:                IF NA$="DEL" THEN GOSUB 1520:GOTO 1505
351:                FIXED(X%)=VAL(NA$)
352: 1510           FIXED=FIXED+FIXED(X%)
353:          NEXT X%
354:          PRINT CL$
355:                                          RETURN
356: 1520     FOR Y%=X% TO F%
357:                FIXED$(Y%)=FIXED$(Y%+1)
358:                FIXED(Y%)=FIXED(Y%+1)
359:          NEXT Y%
360:                F%=F%-1
361:                                          RETURN
362: REM RESET VARIABLE DATA
363: 1600     PRINT CL$
364:          VAR=0
365:          SPENT.VAR=0
366:          FOR X%=1 TO V%
367: REM RETURN POINT FOR CALC
368: 1605           PRINT VAR$(X%)
369:                PRINT VAR(X%)
370:                IF ADJ% THEN PRINT "Amount Spent"; ELSE \
371:                                PRINT "New Amount";
372:                INPUT LINE NA$
373:                PRINT
374:                IF NA$="CALC" THEN GOSUB 1800:GOTO 1605
375:                IF ADJ% THEN INCOME=INCOME-VAL(NA$):\
376:                           VAR(X%)=VAR(X%)-VAL(NA$):\
377:                           SPENT.VAR(X%)=SPENT.VAR(X%)+VAL(NA$):\
378:                           SPENT.VAR=SPENT.VAR+SPENT.VAR(X%):\
379:                                GOTO 1610
380:                IF NA$="" THEN 1610
381:                IF NA$="DEL" THEN GOSUB 1620:GOTO 1605
382:                VAR(X%)=VAL(NA$)
383: 1610           VAR=VAR+VAR(X%)
384:          NEXT X%
385:          PRINT CL$
386:                                          RETURN
387: 1620     FOR Y%=X% TO V%
388:                VAR$(Y%)=VAR$(Y%+1)
389:                VAR(Y%)=VAR(Y%+1)
390:          NEXT Y%
391:                V%=V%-1
392:                                          RETURN
393: REM RESET OTHER DATA
394: 1700     PRINT CL$
395:          OTHER=0
396:          SPENT.OTHER=0
397:          FOR X%=1 TO O%
398: REM RETURN POINT FOR CALC
399: 1705           PRINT OTHER$(X%)
400:                PRINT OTHER(X%)
401:                IF ADJ% THEN PRINT "Amount Spent"; ELSE \
402:                                PRINT "New Amount";
403:                INPUT LINE NA$
404:                PRINT
405:                IF NA$="CALC" THEN GOSUB 1800:GOTO 1705
406:                IF ADJ% THEN INCOME=INCOME-VAL(NA$):\
407:                           OTHER(X%)=OTHER(X%)-VAL(NA$):\
408:                           SPENT.OTHER(X%)=SPENT.OTHER(X%)+VAL(NA$):\
409:                           SPENT.OTHER=SPENT.OTHER+SPENT.OTHER(X%):\
410:                                GOTO 1710
411:                IF NA$="" THEN 1710
412:                IF NA$="DEL" THEN GOSUB 1720:GOTO 1705
413:                OTHER(X%)=VAL(NA$)
414: 1710           OTHER=OTHER+OTHER(X%)
415:          NEXT X%
416:          PRINT CL$
417:                                          RETURN
418: 1720     FOR Y%=X% TO O%
419:                OTHER$(Y%)=OTHER$(Y%+1)
420:                OTHER(Y%)=OTHER(Y%+1)
421:          NEXT Y%
422:                O%=O%-1
423:                                          RETURN
424: REM CALCULATOR ROUTINE
425: 1800     PRINT "Calculator."
426:          PRINT "Use C to clear.  Use RETURN for result."
427:          PRINT
428:                RESULT=0
429: 1810           OP$="+"
430:          INPUT "Number?";LINE N$
431:          IF N$="" THEN 1830
432:          IF LEFT$(N$,1)="C" THEN RESULT=0:PRINT:PRINT:PRINT:GOTO 1810
433:          FIRST$=LEFT$(N$,1)
434:          IF\
435:             FIRST$<>"+" AND FIRST$<>"-" AND FIRST$<>"="\
436:                         AND\
437:             FIRST$<>"*" AND FIRST$<>":" AND FIRST$<>"/" AND FIRST$<>"?"\
438:                         THEN 1820
439:          OP$=FIRST$
440:          IF OP$="*" OR OP$=":" OR OP$="/" OR OP$="?" OR OP$=";"\
441:                OR OP$="=" THEN N$=MID$(N$,2,LEN(N$))
442: 1820     N=VAL(N$)
443:          IF OP$="+" OR OP$=";" OR OP$="-" OR OP$="="\
444:                THEN RESULT=RESULT+N
445:          IF OP$="*" OR OP$=":" THEN RESULT=RESULT*N
446:          IF OP$="/" OR OP$="?" AND RESULT<>0 AND N<>0\
447:                THEN RESULT=RESULT/N
448:          GOTO 1810
449: 1830     PRINT RESULT
450:          INPUT "Finished?";LINE Q$
451:          IF LEFT$(Q$,1)<>"Y" THEN PRINT:PRINT:PRINT RESULT:GOTO 1810
452:                                          RETURN
453: REM OPEN FILE
454: 1900     OLD.FILE%=0
455:          IF END #1 THEN 1910
456:          OPEN FL$ AS 1
457:                OLD.FILE%=1
458:                GOTO 1920
459: 1910     IF READ% THEN 1920
460:          CREATE FL$ AS 1
461: 1920                                     RETURN
462: END

NO ERRORS DETECTED
CONSTANT AREA:      8
CODE SIZE:       5401
DATA STMT AREA:     0
VARIABLE AREA:    512
```

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CIRCLE 17

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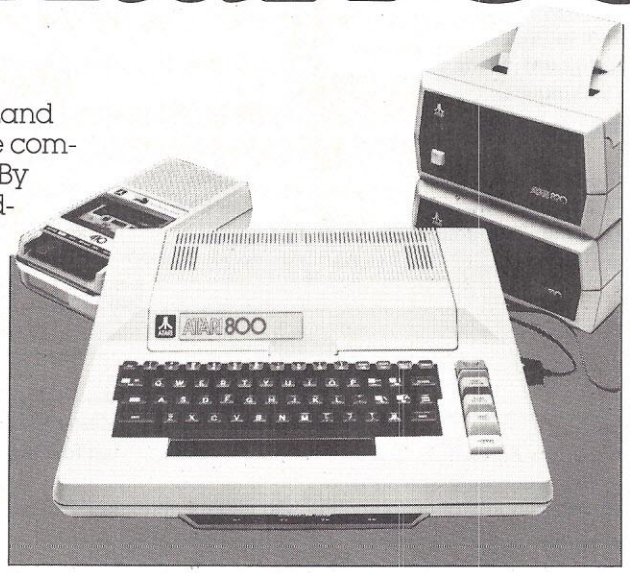

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CIRCLE 18

TRS-80 COLOR COMPUTER

by RALPH BURRIS

Having been one of the early TRS-80 enthusiasts, and recalling the grief and frustration of trying to get a Level I 4K (it took 6 months!), I grabbed the telephone upon hearing of the new TRS-80 Color Computer, and literally forced a dealer to take my order. (What? A color computer? Naw, Radio Shack doesn't have one).

After convincing the dealer by supplying stock numbers, which I had gotten from Ft. Worth, he reluctantly agreed to take the order, but cautioned that it could take a while before the machines would be ready. I assured him I didn't mind, and noted that the ads stated deliveries would begin in late September, thus I would not expect to see anything until January, '81. Imagine my surprise when the TRS-80 Color Computer (serial #117) appeared on my doorstep on September 9th!

Step-by-Step Manuals

The color computer comes with 2 manuals. The "TRS-80 Color Computer Operation Manual" is a concise, well-organized pamphlet that takes the user step-by-step through hook-up and checkout procedures. It includes some test programs for TV alignment and color level settings, and a trouble-shooting chart if anything unexpected develops. The manual concludes with a pictorial description of the various I/O ports, including the specifications for cassette and RS-232 peripherals with pin-outs for these two ports.

Specifications of the RS-232 printer driver are also detailed (600 baud, 1 start bit, 7 data bits, two stop bits, no parity, 132-column print width and automatic carriage return.

The second manual is called "Getting Started with Color BASIC" and serves to introduce the new user to the fundamentals of BASIC. The book emulates the style of Dr. David Lien's classic "User's Manual For Level I", complete with drawings of our friendly animated computer and easily comprehended programming examples. Unfortunately, as is revealed by the (anonymous) authors at the conclusion of the work, not all of the statements available in Color BASIC are discussed in this manual. The reader is advised that the full command set is to be found on the reference card, and a list of suggested reading is given to more fully explore BASIC statements.

The book is no doubt adequate for a beginner to enjoy his new TRS-80 Color Computer, and a return-mail postcard (your stamp) is included with the promise of more complete documentation to come. For this reason there is no need to be too harsh on Radio Shack for failing to mention the ON . . . GOTO statement, or for omitting the ELSE option from the IF . . . THEN discussion. The only area that really shouldn't have been skipped over is that of file handling, which is a very powerful feature of Color BASIC, and is difficult to understand even for a confessed software hack.

The omission of these and other subjects from the manual leads me to believe that, perhaps, the authors really didn't have a fully implemented version of Color BASIC to work with at the time the manual was being written.

The TRS-80 Color Computer from Radio Shack features Microsoft BASIC in ROM and an expansion slot for game cartridges or Extended BASIC.

The BASIC instruction set

One of the surprises in Color BASIC is the strong resemblance to Model I's Level II. In fact, anyone familiar with Level II will feel

quite at home with Color BASIC. All of the string-handling functions in Level II are implemented in Color BASIC, as well as such handy items as INKEY$, ASC, CHR$, VAL, etc. Also included are PEEK, POKE, USR (0), and a function similar to SYSTEM, called EXEC.

Some of the things you won't find in Color BASIC are editing, DELETE, error trapping, advanced math functions (except SIN), STRING$, and so on. You still get all the operators, however, as well as the same abbreviations of Level II.

Here are some of the new instructions in Color BASIC:

■ **AUDIO ON/OFF**—causes the audio output from the cassette recorder to play through the TV speaker. This is handy for monitoring loading operations (although it is hardly necessary with the 1500 baud tape)—but the real potential of this feature is use of prerecorded audio tapes to be played-back during a program (such as music or dialog).

■ **MOTOR ON/OFF**—this is an easy one. It turns the cassette relay on or off.

■ **SOUND x, y**—plays a note through the TV speaker with x=tone and y=duration. (Both x and y are in the range of 0-255.) The notes which are produced by SOUND are identical to those which various programmers have utilized in Level II through manipulation of the cassette port on the Model I. In fact, SOUND is a function of Color BASIC's software, and all processing stops while a tone is being generated, just like Level II.

■ **JOYSTK (x)**—tests the status of the two (optional) joysticks. Where x is a value from 0-3, and returns horizontal coordinates (0 & 2) or vertical coordinates (1 & 3) for each input. Oddly, the user must test JOYSTK (0) prior to testing any other value, or a wrong value is returned.

Some interesting variations on familiar statements are:

■ **CLEAR n,h**—clears n bytes of string space and sets h as a sort of Memory Size. (h is optional.)

■ **CLS c**—clears the screen with c as an optional color to serve as a background. The value of c is in the range of 0-8, which gives a screen color of Black, Green (normal), Yellow, Blue, Red, Buff, Cyan, Magenta or Orange.(CLS9 and above produce an interesting error message—MICROSOFT appears on the screen. This is the only visible evidence of Microsoft's authorship of Color BASIC.)

The computer is capable of generating nine distinct colors, as can be seen in the above screen photograph. The actual colors produced vary with the television and its adjustments.

■ **SET (x,y,c)**—is the familiar graphics command with the added feature of a color value (c = 0-8). This is a nifty feature, and will be explored further. RESET (x,y) remains unchanged.

Cassette I/O is handled quite differently in Color BASIC. Each program or data file is allowed up to eight letters for a filename, and the 1500 baud tape is quite rapid compared to Level II. The cassette I/O routines are similar to those employed on some other micros (e.g., Commodore PET), and disk users will notice some familiar terms and functions:

■ **CLOAD "filename"**—searches the tape for specified file and loads it. As the tape is searched, the letter "S" (green background) is displayed in the upper left-hand corner of the TV, and each filename is printed as it is found. When the program with "filename" is found, an "F" (found)—black background)—appears and the file is loaded.

■ **CLOADM "filename"**—loads a machine language program and replaces the "SYSTEM" load of Level II. (More on this later.)

■ **CSAVE "filename" (,A)**—is the same as Level II, with the exception of the ",A" option, which saves the program as an ASCII text file, like the Model I's disk system.

■ **SKIPF "filename"**—will SKIP Forward to the end of the specified tape file, and return to the command level. This feature allows the user to position the tape to CSAVE or write data at the end of the current files. SKIPF also displays the name of each file as it passes by, so you can see what is on the tape.

Using the file system

Now let's venture into the dreaded (and un-documented) area of file handling. The tape structure is similar to the disk system of the Model I and those of you who are familiar with it will have no problem with most of the concepts. Those who have not experienced the use of files, however, are left in the lurch by the initial manuals.

First, let us consider the cassette files. Each file on the tape is preceded by a header which probably contains the file name and possibly the type of file, although I am guessing at this. Following this header is the text of the file (program or data), and an End of File record of some sort. Saving programs has not changed, but saving data now follows this protocol:

■ **OPEN "m", n, "filename"**—opens a device such as a tape file in (m)ode "I" for input or "O" for output. The second entry, "n", specifies the device number (-1 for cassette), with the given filename. Unlike Model I, only one tape output is supported by Color BASIC.

■ **CLOSE d**—closes all files (devices), or if "d" is specified, only that device is closed. The tape handling routines are quite unforgiving to the hapless programmer who fails to close a cassette file, and subsequent reads of the tape will produce an I/O Error message when an unclosed file is encountered. This is not quite the disaster that is created in the Disk Operating System of a Model I, as you can wind past or record over the offending section of tape, whereas under DOS a lurking monster is unleashed who will eat your disk alive at some future date if a file is not closed properly. (Some have speculated that this beast lives in a secret Randy Cook subroutine known as DESDISK—invoked at a predetermined moment, when you most need the disk files on hand and DEStroys the DISK.)

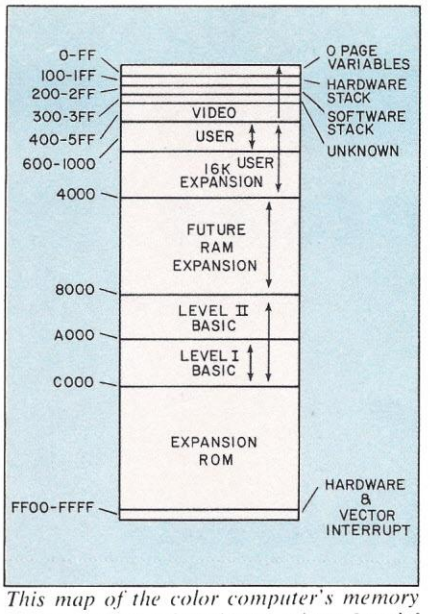
■ **EOF (f)**—as under Disk BASIC, is used to test for the End of File. (f) specifies the file/device number (-1 for cassette). If there is no more data (we have reached the end), a True (-1) is returned. If more data exists, a False (0) condition occurs. This feature is a handy way to check for the end of a file, instead of using a software counter which must be stored along with the data.

■ **INPUT#-1**—is used in the same fashion as Level II to retrieve data from a tape file.

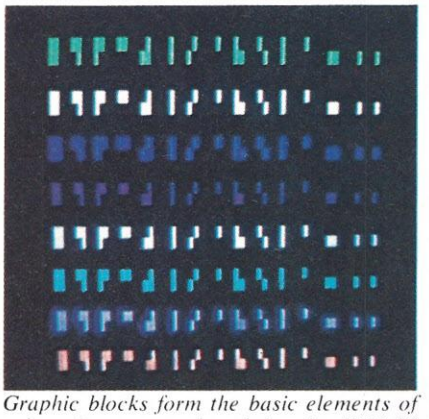
■ **PRINT#-1**—is also used the same way as in Level II.

OK, so what are these "devices" we have mentioned. Well, as you probably know, all the I/O in the Model I is handled through the use of Device Control Blocks (see the memory map in your Level II Re-

Continued on page 70

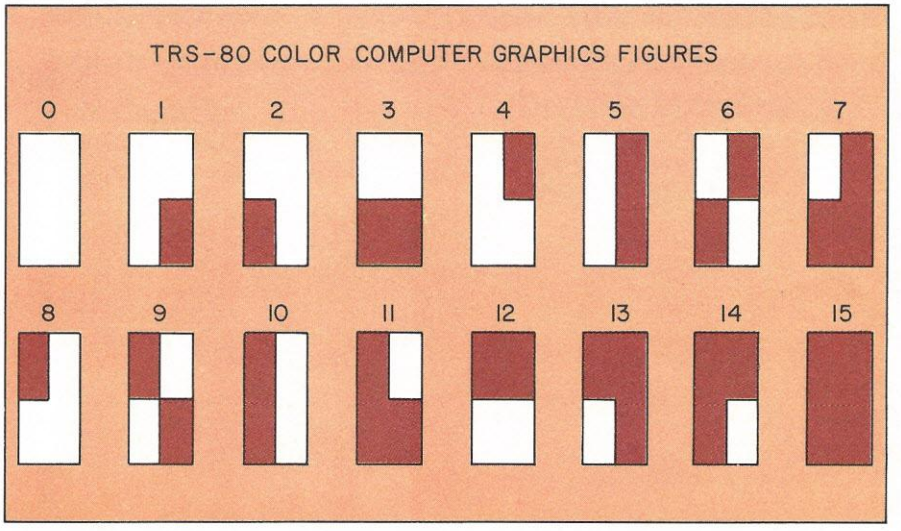


This map of the color computer's memory shows, among other things, where Level I and Level II BASIC reside.



Graphic blocks form the basic elements of color pictures produced by the TRS-80 Color unit. As can be seen above, they are available in all colors.

Built into the computer is a 53-key keyboard for inputting programs and an rf modulator so that it can be connected to any color television.



There are a total of 16 graphics blocks available in Radio Shack's new color computer. Each of these sixteen blocks is available in any of the eight colors that the computer can display.

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CIRCLE 5

How to Afford That Dream House

By William Lappen

There is no question that real estate prices are extremely high. If you are of the opinion that the prices will continue to rise, you may be trying to figure out how to get into the market. This article will show you a way to put your available assets to use in the purchase of your dream house (or at least get closer to it).

Let's follow a hypothetical fellow around to see how the method works. Assume George gets a promotion to a better job within his national firm. The promotion requires George to relocate in another city. Currently, George owns a house. Since he knows that his house is worth more now than when he bought it, George is looking forward to selling the house and relocating.

George puts his house on the market and it is sold for $80,000. George congratulates himself on making $40,000 on his house. He puts the $40,000 together with his bank account balance of $10,000 and sets off in search of his dream house in the new city.

George is a little disturbed by the prices of real estate in the new city but finds a very nice house for $130,000. George has decided that he doesn't want to spend more than 25% of his gross income for housing. He will be making $30,000 in his new position. This means that he will not want to pay more than $7,500 per year for all housing costs.

If George were to put his whole nest-egg ($50,000) down on the house and borrow the remainder ($80,000) at 13% interest for 30 years, his monthly payments would be $884.96. This is $10,619.52 per year. George becomes depressed when he realizes that he will also have to pay about $4,000 in insurance, taxes, and maintenance. Now he is faced with an annual bill of about $14,620 for that house. This is about twice the amount that he wanted to spend on housing.

But how can that be? After all, George is earning a very good living and has a large amount to put down on this house. Something must be wrong with any real estate market that won't allow a person like George to buy a house that costs about 4 times as much as his annual salary. Something probably is wrong, but there are ways George can afford that house.

First, George needs to realize that most of his mortgage payments for the first few years are deductible from his income for federal income tax purposes. This means that if George is in the 40% tax bracket both before and after the deduction, the IRS will pay for 40% of his interest. The interest on the $80,000 is about $10,400 for the first year, which means that George is going to save $4,160 on his taxes. If George is willing to use this tax savings on his house, he will be able to increase his payments from $7,500 per year to $11,660. That's better, but still almost $3,000 short of being able to comfortably afford the house.

Now it's time to turn to a computer. This program is written for a TRS-80 with at least 16K RAM and Level II. (Notice in the listing that the up arrow used for exponentia-

---

Mr. Lappen spends much of his free time creating progams to help solve business and management problems.

Program Listing

```
10 'HOUSE PAYMENTS 8/5/80
20 CLEAR 1000
30 DATA YEARS,GROSS EARNINGS,% INCREASE,FIRST LOAN $,INTEREST,TERM
40 DATA SECOND LOAN $,INTEREST,TERM,ANNUAL COSTS
50 DATA AVAIL ASSETS,GROWTH RATE,TAX BRACKET,DOWN PAYMENT
60 DATA% TO HOUSE
70 B$=CHR$(8)
80 B$=STRING$(4," ")+STRING$(4,B$)
90 DEFINT C,S
100 X=15
110 S=6
120 'S IS SPACING AND X IS # OF ENTRIES
130 DIM A(X+4),L(2),C(8),B(8),A$(X)
140 FOR I=1 TO X+4
150 A(I)=0
160 NEXT I
170 F1=0
180 FOR I=1 TO X
190 READ A$(I)
200 NEXT I
210 CLS
220 PRINT TAB(20) "HOUSE PAYMENTS"
230 FOR I=1 TO X
240 L=INT((I-1)/3)+1
250 PRINT @ L*128+1+22*(I-1-INT((I-1)/3)*3), I; " "; A$(I);
260 NEXT I
270 IF F=0 GOTO 340
280 FOR I=1 TO X
290 L=(INT((I-1)/3)+1.5)*128+22*(I-1-INT((I-1)/3)*3)
300 PRINT@L,;
310 PRINT USING "##,###,###"; A(I);
320 NEXT I
330 GOTO 460
340 FOR I=1 TO X
350 L=(INT((I-1)/3)+1.5)*128+22*(I-1-INT((I-1)/3)*3)
360 PRINT @ 916, CHR$(30)
370 PRINT @ 916, A$(I);
380 INPUT A(I)
390 PRINT @ L,;
400 PRINT USING "##,###,###"; A(I);
410 IF I<>1 GOTO 430
420 IF A(1)>8 GOTO 370
430 IF I<>12 GOTO 440
440 IF F=0 NEXT
450 F=1
460 PRINT @ 916,"CORRECT (Y/##/P/END) ";
470 INPUT E$
480 IF E$="P" GOSUB 1680 : GOTO 460
490 IF E$="Y" GOTO 570
500 IF E$="END" THEN END
510 E=VAL(E$)
520 IF E>X GOTO 460
530 H=1
540 IF E<0 GOTO 460
550 I=E
560 GOTO 350
570 F=1
580 FI=4
590 IF A(FI+1)=0 OR A(FI+2)=0 GOTO 660
600 A(X+F)=(A(FI+1)/1200)/(1-((1+(A(FI+1)/1200))[(-A(FI+2)*12)))*A(FI)
610 IF F=2 GOTO 660
620 IF A(5)=0 A(X+2)=0: GOTO 660
630 F=2
640 FI=7
650 GOTO 590
660 CLS
670 C=A(X+1)
680 M=1
690 IF C>50 THEN M=M*10: C=C/10: GOTO 690
700 A$=STR$(M)
710 A$=RIGHT$(A$,LEN(A$)-2)
720 PRINT TAB(20) "HOUSE PAYMENTS  (";A$;")"
730 FOR I=1 TO A(1)
740 PRINT TAB(10+I*S) I;
750 NEXT I
760 PRINT
770 FOR I=1 TO A(1)
780 C(I)=0
790 B(I)=0
800 NEXT I
810 C(1)=A(14)/M
820 F=4
830 FI=X+1
840 FOR I=1 TO A(1)
850 IF I>A(F+2) GOTO 880
860 C=A(FI)*12/M+.5
870 C(I)=C(I)+C
880 NEXT I
890 IF F=7 GOTO 930
900 F=7
910 FI=X+2
920 GOTO 840
930 PRINT "INTEREST DEDUCT"
940 F=4
950 FI=X+1
960 PRINT "    FIRST";
970 A(FI+2)=A(F)
980 FOR I=1 TO A(1)
990 IF I>A(F+2) GOTO 1090
1000 D=0
1010 FOR J=1 TO 12
1020 L=A(FI+2)*A(F+1)/1200
1030 A(FI+2)=A(FI+2)-A(FI)+L
1040 D=D+L
1050 NEXT J
1060 C=D/M+.5
1070 B(I)=B(I)+C
1080 PRINT TAB(10+I*S) C;
1090 NEXT I
1100 PRINT
1110 IF F=7 GOTO 1170
1120 F=7
1130 FI=X+2
1140 IF A(F)=0 GOTO 1170
1150 PRINT "    SECOND";
1160 GOTO 970
1170 PRINT
1180 PRINT "CASH PAYMENTS -";
1190 FOR I=1 TO A(1)
1200 C(I)=C(I)+INT(A(10)/M+.5)
1210 PRINT TAB(10+I*S) C(I);
1220 NEXT I
1230 PRINT
1240 PRINT "TAX BENEFIT   +";
1250 FOR I=1 TO A(1)
1260 C=B(I)*A(13)/100+.5
1270 PRINT TAB(10+I*S) C;
1280 C(I)=C(I)-C
1290 NEXT I
1300 PRINT
1310 PRINT "CASH NEEDED     ";
1320 FOR I=1 TO A(1)
1330 PRINT TAB(10+I*S) C(I);
1340 NEXT I
1350 PRINT
1360 PRINT
1370 PRINT "GROSS EARNINGS";
1380 FOR I=1 TO A(1)
1390 B(I)=INT(A(2)*((1+A(3)/100)[(I-1))/M+.5)
1400 PRINT TAB(10+I*S) B(I);
1410 NEXT I
1420 PRINT
1430 PRINT "AVAIL FOR HOUSE";
1440 FOR I=1 TO A(1)
1450 B(I)=INT(B(I)*A(15)/100+.5)
1460 PRINT TAB(10+I*S) B(I);
1470 NEXT I
1480 PRINT
1490 PRINT "ASSETS NEEDED";
1500 D(0)=INT((A(11)-A(14))/M+.5)
1510 FOR I=1 TO A(1)
1520 C=C(I)-B(I)
1530 PRINT TAB(10+I*S) C;
1540 IF I=1 THEN C=C-A(14)/M
1550 D(I)=INT(D(I-1)*(1+A(12)*(1-A(13)/100)/100)-C+.5)
1560 NEXT I
1570 PRINT
1580 PRINT "ASSETS LEFT";
1590 FOR I=1 TO A(1)
1600 PRINT TAB(10+I*S) D(I);
1610 NEXT I
1620 PRINT
1630 PRINT TAB(10)"DO YOU WANT HARDCOPY (Y/N) ";
1640 A$=INKEY$
1650 IF A$="" GOTO 1640
1660 IF A$="Y" GOSUB 1680
1670 GOTO 210
1680 'SUB TO PRINT SCREEN
1690 FOR IH=0 TO 14
1700 KK=15360+IH*64
1710 A$=""
1720 FOR IJ=0 TO 63
1730 A$=A$+CHR$(PEEK(IJ+KK))
1740 NEXT IJ
1750 LPRINT A$
1760 A$=INKEY$
1770 IF A$<>"" RETURN
1780 NEXT IH
1790 RETURN
```

tion is printed as a left square bracket. This appears in lines 600 and 1390.)

Looking at Figure 1, notice that the analysis was run for 8 years using $30,000 for the base salary and a growth rate of 10% for that salary. (The input numbers are directly below the title. The numbers preceding the title are for changing the numbers before the next run.) We have assumed the George will by able to earn 7% (before taxes) on whatever assets he manages to accumulate.

Figure 2 shows the results of the analysis. It is scaled in hundreds of dollars (signalled by the "(00)" in the title). The years are labelled across the top. Interest is calculated on a monthly basis and added for annual tax treatment. For example, the interest on the first (and only) loan is about $10,400 for the year. This translates into a tax benefit of about $4,200 in the 40% bracket.

CASH PAYMENTS is the total amount of money needed on the house for the year. It includes mortgage payments of principal and interest along with the ANNUAL

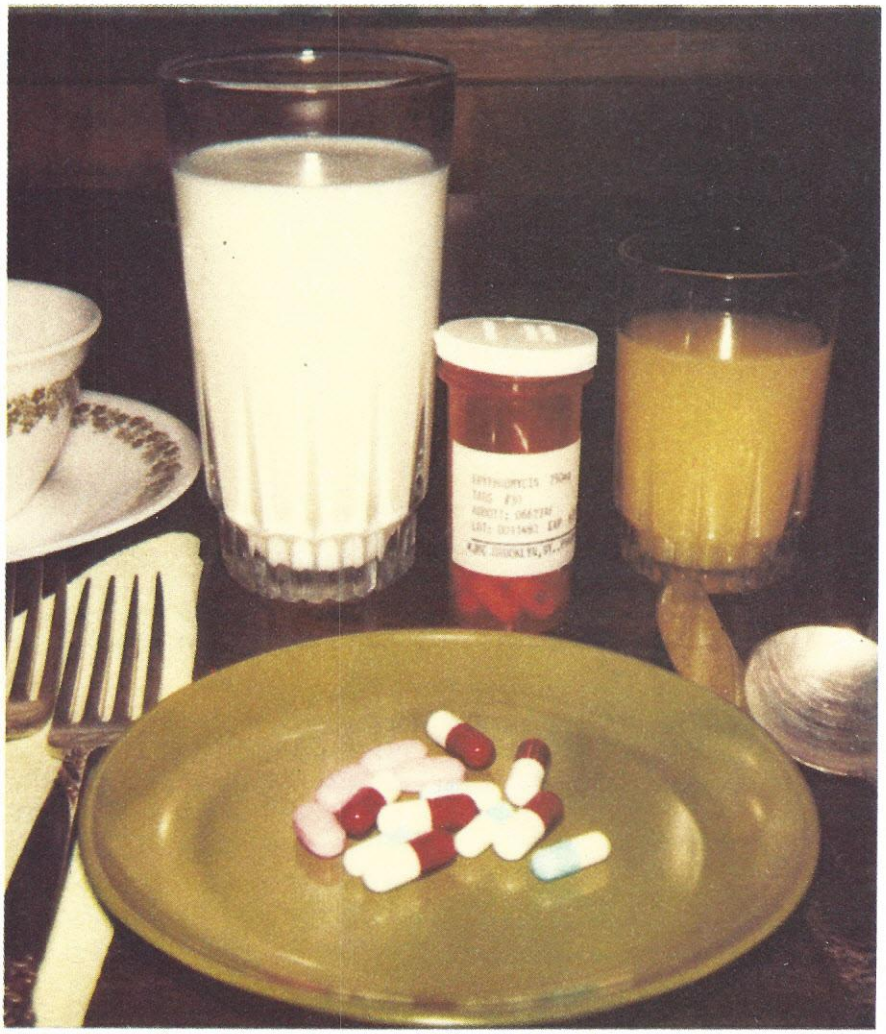
continued on page 104

Drug and Food Incompatibilities

BY RINALDO F. PRISCO

This article describes a program that accepts a drug's name as input, performs a binary search and, if successful, outputs a classification of the drug together with a list of foods to avoid. This is a simplistic approach to the very complex relationship between drugs, foods and physical conditions. So at best the program may provide a loose rule of thumb for the general case; however to be on the safe side **always** *check with your physician. The interactions between drugs and foods can have a profound effect on your health.*

I became aware of these facts about a year ago. One afternoon, as I was having a cup of coffee, I glanced through my wife's copy of *Woman's Day* magazine which happened to be on the kitchen table. It contained a very informative article by Robert J. Benowicz which clearly delineated the problem of interacting foods and drugs. The drug-food data used in Program Listing 1 is based on a chart which appeared in that article (July 17, 1979).

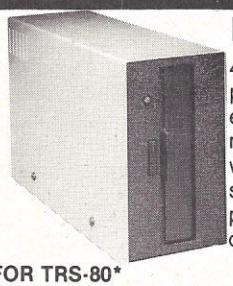


Instead of prescribing foods to avoid, a more positive approach would be to consider foods to favor. (Carlton Fredricks where are you?) There is ample literature on good nutrition and its healthful effects but little in conjunction with drugs. It is not unusual for a patient to receive both a diet list and a drug prescription from a physician. So perhaps the program can be modified to also provide a list of foods to favor with certain drugs.

Even more helpful would be a consideration of the incompatibilities between various drugs. But this is a more complex problem for which I do not have any data. Given the right data, the program can be modified to process it. So how about it, you pharmacists, nurses and physicians, what should be avoided with what?

Before getting to the particular program at hand, let me look ahead to the ideal program. There should be many inputs, similar to those for the medical history forms we have all filled out for hospitals and physicians. Once this data has been processed, there should be a branch to a routine which requests supplementary data. The final printout should include: a list of foods to avoid, a list of foods to favor, and a list of drug incompatibilities, including over-the-counter drugs. Such a program is probably churning about in some macro somewhere (if not, why not?). But for now, we will look at a rather modest program that makes no claims of completeness or absolute accuracy. It is pre-

WE WILL NOT BE UNDERSOLD



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CIRCLE 19

Program Listing 1

```
100 REM                    FOOD & DRUGS
110 REM
120 REM                 Rinaldo F. Prisco
130 REM                 RD #7 Edgebrook
140 REM                 Oswego, NY 13126
150 REM
160 D=20
170 DIM D$(150*D),N$(D),I$(D-5),F$(D)
180 REM     SET DRUG STRING D$ AND GET INPUT I$
190 !#P,"SETTING DRUG STRING; READY IN A FEW SECONDS...":!#P
200 READ N$:IF N$="EOF" THEN 210
205 D$(N*D+1)=N$:N=N+1:GOTO 200
210 INPUT "Enter drug's name: ",I$
220 FOR I=1 TO LEN(I$):L=ASC(I$(I,I))
230 IF L>64 AND L<91 THEN I$(I,I)=CHR$(L+32)
240 NEXT I
250 N$="                        "
260 REM     BINARY SEARCH FOR I$
270 L=1:U=N
280 F=INT((L+U)/2)
290 N$=D$((F-1)*D+1):N$=N$(1,LEN(I$)+5)
300 IF I$=N$(6) THEN 400
310 IF L>=U THEN 340
320 IF I$<N$(6) THEN 330
325 L=F+1:GOTO 280
330 U=F-1:GOTO 280
340 REM     NOT ON LIST
350 !#P:!#P,I$," is not on the list."
360 !#P:!#P,"----------------------------------------"
370 INPUT "Do you want to try again? ",Y$
380 IF Y$(1,1)="y" THEN 210
390 IF Y$(1,1)="Y" THEN 210 ELSE END
400 REM     ON LIST - PROCESS IT
410 J=0
420 J=J+1:K=VAL(N$(J,J)):IF K=0 THEN 440
430 GOSUB 460:GOTO 420                    :REM CLASSES
440 J=J+1:K=ASC(N$(J,J)):IF K=32 THEN 360
450 K=K-48:GOSUB 890:GOTO 440             :REM FOODS
460 REM     CLASSIFICATION ROUTINES
470 !#P:!#P,"Classification: ",
480 ON K GOTO 490,530,550,590,630,680,740,790,850
490 REM     1 ERYTHROMYCIN ANTIBIOTIC
500 !#P,"Erythromycin Antibiotic":!#P
510 !#P,"Can be destroyed by stomach acids":!#P
520 K=1:GOSUB 910:RETURN
530 REM     2 PENICILLIN ANTIBIOTIC
540 !#P,"Penicillin Antibiotic":!#P:GOTO 510
550 REM     3 TETRACYCLINE ANTIBIOTIC
560 !#P,"Tetracycline Antibiotic":!#P
570 !#P,"Calcium retards effectiveness"
580 K=2:GOSUB 910:RETURN
590 REM     4 ANTICOAGULANTS
600 !#P,"Anticoagulant":!#P
```

```
610 !#P,"Vitamin K increases blood clotting factor"
620 K=3:GOSUB 910:RETURN
630 REM     5 THYROID PREPARATION
640 !#P,"Thyroid Preparation":!#P
650 !#P,"Some foods contain substances which reduce the "
660 !#P,"production of thyroid harmone"
670 K=8:GOSUB 910:RETURN
680 REM     6 ANTIDEPRESSANT
690 !#P,"Antidepressant":!#P
700 !#P,"When taken with foods rich in Tyramine the result"
710 !#P,"can be elevated blood pressure, headaches, nosebleeds"
720 !#P,"and strokes."
730 K=4:GOSUB 910:RETURN
740 REM     7 ANTIHYPERTENSIVE
750 !#P,"Antihypertensive":!#P
760 !#P,"AVOID",
770 !#P," natural licorice; can cause salt and water ",
780 !#P,"retention":RETURN
790 REM     8 DIURETICS
800 !#P,"Diuretic":!#P
810 !#P,"AVOID ",
820 !#P,"Monosodium glutamate (MSG); it also acts as"
830 !#P,"a diuretic; essential water-soluble vitamins and"
840 !#P,"minerals may be lost":RETURN
850 REM     9 LEVODOPA
860 !#P,"Levodopa":!#P
870 !#P,"Too much protein or vitamin B6 interfers with L-dopa"
880 K=7:GOSUB 910:RETURN
890 REM     FOOD ROUTINES
900 !#P:!#P,"also ",
910 !#P:!#P,"AVOID"
920 ON K GOTO 930,940,950,960,970,980,990,1000
930 RESTORE 1370:GOTO 1010
940 RESTORE 1410:GOTO 1010
950 RESTORE 1440:GOTO 1010
960 RESTORE 1470:GOTO 1010
970 GOTO 770
980 GOTO 820
990 RESTORE 1520:GOTO 1010
1000 RESTORE 1550
1010 REM     READ & PRINT FORMATTED FOODS
1020 !#P:Q=0
1030 READ F$:IF F$="EOF" THEN RETURN
1040 !#P,TAB(Q),F$,:Q=Q+15:IF Q<60 THEN 1030 ELSE 1020
1050 DATA "30   achrostatin","805  aldactone","780  aldoclor"
1060 DATA "780  aldomet","780  aldoril","805  anhydron"
1070 DATA "805  aquatag","30   archromycin","30   azotrex"
1080 DATA "90   bendopa","20   bicillin","10   bristamycin"
1090 DATA "50   chloxin","20   compocillin","40   coumadin"
1100 DATA "30   cyclopar","30   declomycin","30   declostatin"
1110 DATA "805  diamox","805  dicumarol","780  diupres"
1120 DATA "805  diuril","90   dopar","30   doxy-ii"
1130 DATA "20   duracillin","10   e-mycin","780  enduronyl"
1140 DATA "805  esidrix","780  esimil","10   ethril"
1150 DATA "706  eutonyl","706  eutron","40   heparin"
1160 DATA "805  hydromox","780  hydropres","805  hygroton"
```

continued

```
1170 DATA "10   ilosone","10   ilotycin","70   inderal"
1180 DATA "780  ismelin","30   kesso-tetra","10   kesso-mycin"
1190 DATA "90   larodopa","805  lasix","20   ledercillin"
1200 DATA "50   letter","40   lipo-hepin","60   marplan"
1210 DATA "30   minocin","40   miradon","805  naqua"
1220 DATA "780  naquival","60   nardil","20   omnipen"
1230 DATA "805  oretic","40   panheprin","40   panwarfin"
1240 DATA "60   parnate","20   pathocil","10   pediamycin"
1250 DATA "20   pen-vee k","10   pfizer-e","40   phenindione"
1260 DATA "10   principen","10   qidmycin","30   qidtet"
1270 DATA "780  regroton","70   reserpine","30   retet"
1280 DATA "20   robicillin","10   robimycin","30   robitet"
1290 DATA "30   rondomycin","70   sandril","70   ser-ap-es"
1300 DATA "70   sinemet","805  singoserp","40   sintrom"
1310 DATA "30   steclin","30   sumycin","50   synthroid"
1320 DATA "50   tapazole","30   terramycin","30   tetracycline"
1330 DATA "30   tetracyn","30   tetrex","50   thiouracil"
1340 DATA "50   thyrolar","805  unipres","30   urobiotic"
1350 DATA "20   v-cillin","30   vectrin","30   vibramycin"
1360 DATA "EOF"
1370 REM     1 ACID FOODS
1380 DATA "Coffee","Tea","Fruit juices","Tomatoes","Vinegar"
1390 DATA "Pickles"
1400 DATA "EOF"
1410 REM     2 CALCIUM FOODS
1420 DATA "Cheese","Milk","Yogurt","Pizza","Ice cream"
1430 DATA "EOF"
1440 REM     3 VITAMIN K FOODS
1450 DATA "Liver","Brussels sprts","Kale","Cabbage","Spinach"
1460 DATA "EOF"
1470 REM     4 TYRAMINE FOODS
1480 DATA "Coffee","Tea","Beer","Bananas","Raisins","Wine"
1490 DATA "Cola drinks","Chicken liver","Sausages","Soy sauce"
1500 DATA "Mushrooms","Chocolate"
1510 DATA "EOF"
1520 REM     7 VITAMIN B6 FOODS
1530 DATA "Liver","Wheat germ","Yeast"
1540 DATA "EOF"
1550 REM     8 THYROID INHIBITORS
1560 DATA "Brussels sprts","Cabbage","Cauliflower","Turnips"
1570 DATA "Rutabaga","Soybeans"
1580 DATA "EOF"
```

sented from the viewpoint of a programming exercise and a promising application of microcomputing.

Lines 1050 to 1350 contain the data for the extended names of each drug. The extended name of a drug consists of the drug name prefaced by space for five classification characters (only three of which are now used but we have allowed room for expansion). The first character in the extended name is a digit which specifies a classification for the drug. If there are multiple classifications, subsequent characters are used. The end of the classification codes is indicated by the zero character. If numerical characters follow the zero character, they represent additional food classes that should be avoided. Thus the first extended name "805 esidrix" in line 1140 indicates that esidrix belongs to drug class 8, diuretics; in addition to avoiding MSG for diuretics, the 5 (food class 5) after the zero indicates that natural licorice should be avoided.

Line 480 directs the program flow for the drug classification and line 920 for the foods. Allowance is made for different drug classes to have common lists of foods. The food lists are specified by the variable K in each of the drug classes from lines 460 to 880.

The food classes are listed in lines 1370 to 1580. They each end with "EOF" for End Of File and are accessed by extended use of the RESTORE statement. For example, line 950 RESTOREs 1440, the vitamin K foods. These are subsequently READ and PRINTED in lines 1010 to 1040.

Before the program does anything with a drug name (I$ entered in line 210), it first converts the letters in I$ to lower case (lines 220 to 240). This allows flexibility in how

a drug name should be input; lower case, upper case or mixed cases are all treated the same way.

Once the drug name (I$) is processed into standard form, a binary search routine quickly checks through the list of sorted drug names (D$). Line 290 gets an extended drug name (N$) from the list (D$) and cuts the length of N$ down to that of I$ plus 5 (for the class-food codes). Line 300 checks for a match with I$ ignoring the codes. If a match is found, program flow is directed to line 400 where the codes, indexed by J, are processed. The procedure terminates when all the codes have been processed (tested for in line 440).

The program in Listing 1 was written in Northstar BASIC. The program code itself requires about 5K. This, together with the RAM used by the program, DOS and interpreter, requires at least 24K starting at 2000H for standard configurations. There are no disk file requirements.

Some of the NS-BASIC programming statements and conventions will seem very strange to those of you who are using versions of Microsoft BASIC. Indeed, if you try to run the program as written with an M-BASIC interpreter, you will get all sorts of error messages.

However, if the lines in Listing 2 are substituted for the lines with the same numbers in Listing 1, the resulting program will run under Microsoft Extended BASIC. In fact, the lines in Listing 2 are those which were left from such a version after the common lines were deleted. Some of the differences between Northstar BASIC and Microsoft Extended BASIC are made quite vivid when the lines in Listings 1 and 2 are compared. I hope they will help you in making translations of other programs as well.

Sample Run

```
RUN

SETTING DRUG STRING; READY IN A FEW SECONDS...

Enter drug's name: ESIDRIX

Classification: Diuretic

AVOID Monosodium glutamate (MSG); it also acts as
a diuretic; essential water-soluble vitamins and
minerals may be lost

also
AVOID
 natural licorice; can cause salt and water retention

----------------------------------------
Do you want to try again? Y
Enter drug's name: ILOSANE

ilosane is not on the list.

----------------------------------------
Do you want to try again? Y
Enter drug's name: ILOSONE

Classification: Erythromycin Antibiotic

Can be destroyed by stomach acids


AVOID

Coffee          Tea             Fruit juices   Tomatoes
Vinegar         Pickles
----------------------------------------
Do you want to try again? NO
READY
```

Program Listing 2

```
160 CLEAR 4000
170 DIM D$(150)
180 REM          SET DRUG STRINGS D$() AND GET INPUT I$
190 PRINT"SETTING DRUG STRINGS; READY SHORTLY...":PRINT
205 D$(N)=N$:N=N+1:GOTO 200
210 INPUT "What is drug's name";I$
220 FOR I=1 TO LEN(I$):L=ASC(MID$(I$,I,1))
230 IF L>64 AND L<91 THEN MID$(I$,I,1)=CHR$(L+32)
250 N$=STRING$(20," ")
290 N$=D$(F):N$=LEFT$(N$,LEN(I$)+5)
300 IF I$=MID$(N$,6,LEN(N$)) THEN 400
320 IF I$<MID$(N$,6,LEN(N$)) THEN 330
350 PRINT:PRINT I$;" is not on the list."
360 PRINT:PRINT STRING$(42,"-")
370 INPUT "Do you want to try again";Y$
380 IF LEFT$(Y$,1)="y" THEN 210
390 IF LEFT$(Y$,1)="Y" THEN 210 ELSE END
420 J=J+1:K=VAL(MID$(N$,J,1)):IF K=0 THEN 440
440 J=J+1:K=ASC(MID$(N$,J,1)):IF K=32 THEN 360
470 PRINT:PRINT "Classification: ";
500 PRINT "Erythromycin Antibiotic":PRINT
510 PRINT "can be destroyed by stomach acids":PRINT
540 PRINT "Penicillin Antibiotic":PRINT:GOTO 510
560 PRINT "Tetracycline Antibiotic":PRINT
570 PRINT "Calcium retards effectiveness":PRINT
600 PRINT "Anticoagulant":PRINT
610 PRINT "Vitamin K increases blood clotting factor"
640 PRINT "Thyroid Preparation":PRINT
650 PRINT "Some foods contain substances which reduce the"
660 PRINT "production of thyroid harmone"
690 PRINT "Antidepressant":PRINT
700 PRINT "When taken with foods rich in Tyramine the result"
710 PRINT"can be elevated blood pressure, headaches, nosebleeds"
720 PRINT "and strokes."
750 PRINT "Antihypertensive":PRINT
760 PRINT "AVOID ";
770 PRINT "natural licorice; can cause salt and water"
780 PRINT "retention":RETURN
800 PRINT "Diuretic":PRINT
810 PRINT "AVOID ";
820 PRINT "Monosodium glutamate (MSG); it also acts as"
830 PRINT "a diuretic; essential water-soluble vitamins and"
840 PRINT "minerals may be lost":RETURN
860 PRINT "Levodopa:PRINT
870 PRINT "Too much protein or vitamin B6 interfers with L-dopa"
900 PRINT:PRINT "also ";
910 PRINT:PRINT "AVOID"
1020 PRINT:Q=0
1040 PRINT TAB(Q) F$;:Q=Q+15:IF Q<60 THEN 1030 ELSE 1020
```

The main differences in the versions, as mentioned in my note on page 9 of the July 1980 issue of PC, involve string handling and printing conventions. The printing differences are minor but annoying. The string differences require major surgery. Even within the large family of fine M-BASICs, there are some differences. Look at line 230 in Listing 2 and note the MID$ on the left of the equals sign. This is allowed in TRS-80 Disk BASIC but not in Level II Cassette BASIC (its effect can be emulated)

The program is easily modified to include many more drugs. It is dimensioned for 150 but only about 100 drugs are listed. If you add new drugs, be sure they are entered in lower case and in alphabetical order in the DATA statements. Similarly, new foods may be added in their DATA statements (any order). With a little more effort, even new food classes can be added.

It would be fairly easy to transfer all data to a tape or disk file but this should only be done if a large data base (say several thousand drug names) is expected or available RAM is inadequate. The procedures used in the program will apply to any similar hierarchical system; objects that can be classified and classifications that imply certain actions. The fundamental problem is to accumulate the data.□

□ Reference

Benowicz, Robert J., *Foods and Drugs You Mustn't Mix,* Woman's Day, July 17, 1979.

Continued from page 59
ference Manual). This means that all devices are interchangeable with one another in that BASIC looks at the DCB for the device it wishes to address, locates the "driver" address for that particular device, and passes on or gets the data it is transferring by invoking the driver subroutine. That is why you can switch your lineprinter output with your screen and vice-versa.

A file can also be a device, given the proper software driver to deal with the function of the device. Thus, systems like Randy Cook's VTOS disk operating system can ROUTE the lineprinter output to a disk file, and so on.

Color BASIC appears to use the concept of "devices" for all of its I/O operations, thus the OPEN, INPUT, EOF and CLOSE statements apply equally to files as well as the video or keyboard (device #0), the Cassette (device #-1), or the Lineprinter (device #-2). The statement "PRINT#-2," replaces "LPRINT" as the method of printing data. Oddly, "LLIST" is retained unchanged.

So how do you use the video or keyboard files? Beats me! Nobody explained that or any other file handling in the first manuals.

Machine language subroutines are accessible from Color BASIC with the familiar PEEK, POKE and USR (O) statements, as well as the previously mentioned EXEC a, which executes the machine language routine at address "a", or defaults to the transfer address loaded through CLOADM. As in Level II, Color BASIC gives an FC error if no address is specified and no object file has been loaded.

While it is great to have such access to the machine level, neither of the manuals discuss these functions, and no memory map is supplied in the first editions. Once again, the novice would be lost in these areas, but heck, without a memory map, most everybody is.

Using the PEEK statement, and with the help of some friends, a rough map of the TRS-80 Color Computer (which follows) has been constructed. But before we look at the map, a few preliminary comments are in order.

System hardware structure

The TRS-80 Color Computer gets its power from a Motorola MC6809E CPU, not the familiar Z-80 of Models I, II and III. This is a very nifty chip which has a lot of power, including such features as relative addressing anywhere in memory, relative page addressing, and so on. If you want to learn more about this SEXy chip (one of its instructions is SEX, which manipulates the sign of an accumulator), look for a series of articles on 6809 machine language programming in Personal Computing starting next month.

If you are familiar only with the architecture of the Z-80, it will come as somewhat of a shock to learn that the entire addressing scheme is the *reverse* of Z-80-based equipment. In other words, when you power up the Model I, it looks at address 0000 for the first instruction, whereas the MC6809 looks at FFFFh to get started. Also, the ROM is at the *top* of memory, not the bottom—and things get even more rearranged from there. This scheme is standard in most other micros, so you may as well get used to it. (Another convention in the MC6809 literature is the use of "$" to denote a hexadecimal value, thus $FFFF is the same as FFFFh in our more familiar lingo.)

To digress for a moment, another thing which makes me think our pals at Tandy's "Z-80 Land" were not quite sure what was happening when the documentation was written, is that the usual addressing scheme of values in the range of -32768 to +32767 are indicated for the PEEK and POKE functions, when in fact Color BASIC doesn't like those silly negative addresses, demanding instead an entry in the range of 0 to 65535.

Ready to take a look inside? OK, but you may as well get used to the "$" meaning hex.

Within the RAM areas are provisions for the video display. For example, in the 4K version the screen can be found at location 1024 (decimal) and is 512 bytes long. In expanded versions, larger chunks of memory will be used to provide for higher screen resolution — promised in Extended Color BASIC.

It may take a while to get used to this new format, but it promises to be a whole lot of fun when you do.

The standard format of the TRS-80 Color Computer's video is 32 characters by 16 lines. The ASCII characters (i.e., alphanumerics) are larger and better defined than the 32 character mode of the Model I, and are displayed (normally) as black against a green background. The Color Computer also supports lower-case entries, but displays lowercase letters as a reverse field uppercase (i.e., green characters on a black field). The lowercase entries will go normally to a printer, however. This method of display is not so bad and actually gives you an alternate character set to play around with.

Graphics on the TRS-80 color are a bit different than Model I, but do come close to the same scheme. There are 128 graphics characters (instead of the familiar 64) which are divided into eight groups of 16 figures. Each figure has four sections (there are six in Model I's graphic block), and each of these may be turned on (SET) with one of the eight available colors, or off (RESET) to black. The graphics characters may also be accessed with CHR$, and offer a lot of possibilities. One problem with using this scheme is that two adjacent blocks in the same character area cannot be SET to different colors. That is, SET (0,0,1): SET (0,1,3) will produce blue for both positions, rather than green and blue. Of course this is because SET and RESET are really just sticking an appropriate value in any given screen location, which didn't make any difference in the Model I's black and white picture.

This is a rough approximation of the basic character set. By adding a value of 128 through 240 in steps of 16, the given color value is included in the blank spaces of each figure. For example, CHR$ (184) printed at location 0 produces a red block in the upper left-hand corner of the screen. The statement SET (0,0,4) has the same effect.

Graphics and alphanumerics may be mixed on the screen, as in the Model I, but each alphanumeric character has a green background (or black if lowercase), and a line printed on the screen without a semicolon will produce one full green line.

Of course one must keep in mind that the TRS-80 Color's graphics sets are controlled by software, and the potential graphics modes of the Motorola video chip set are barely touched by this implementation.

Look for amazing things to happen when some of our favorite programmers get a handle on the system architecture. This is not a rash assumption, by the way — tricking the circuits with a fast on-off power sequence, an incredible variety of shades and colors appeared on the screen—far more than the eight that Color BASIC allows.

As for the outward appearance of the TRS-80 Color, it is housed in a substantial case, which seems to be made of a thicker plastic than the Model I, although the same silver paint is used on the surface. Through the vents, one can see that most of the innards are contained in a metal case, which provides for RF shielding.

The keyboard is similar in style to that of the TI 99/4, with smallish square keys that are separated by a good ¼-inch. This design allows the use of overlay templates for dedicated keyboard applications. The keys are spring-loaded, like some calculators, but the spacing of the "striking" area of each key is so close to the Model I that you barely notice the difference after a few minutes of use.

All of the keys on the Model I are present on the TRS-80 Color, and most (but not all) retain the same functions — the shift-backspace erases the entire line, shift- @ freezes the program execution, and so on.

The keys which are different are:
shift-down arrow = a left bracket
shift-right arrow = a right bracket
shift-up arrow = a left arrow
shift-clear = a back slash
shift-0 = case reverse (upper/lower) - sound familiar?

These key assignments point up one area that is lacking — video control characters. Color BASIC supports only two actual control characters — CHR$ (8) = backspace and erase and CHR$ (13), the carriage-return, linefeed combo. There are none of the other control characters found in the Model I, nor are the space-compression codes (192-255) available. Hopefully, these codes will be reinstated in Extended Color BASIC. □

TRS-80 Color Computer Memory Map

Address	Probable Use & Comments
$FFFF—$FF00	MC6809's initialization address and vectors
$FF00 — $C000	Cartridge ROM area
$C000 — $A000	Color BASIC ROM
$A000 — $8000	Expansion ROM for Extended Color BASIC
$8000 — $4000	Open RAM area in the 4K TRS-80 Color
$4000 — $1000	16K RAM area
$1000 — $000	4K RAM area

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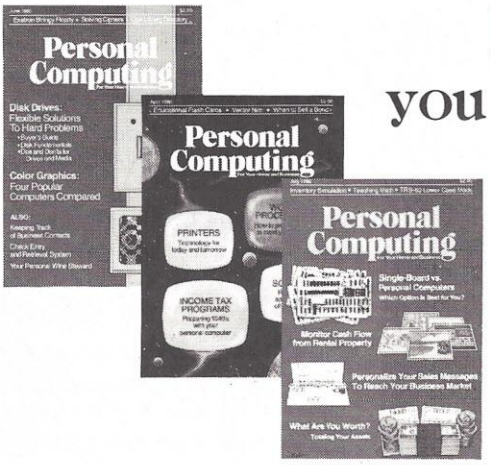

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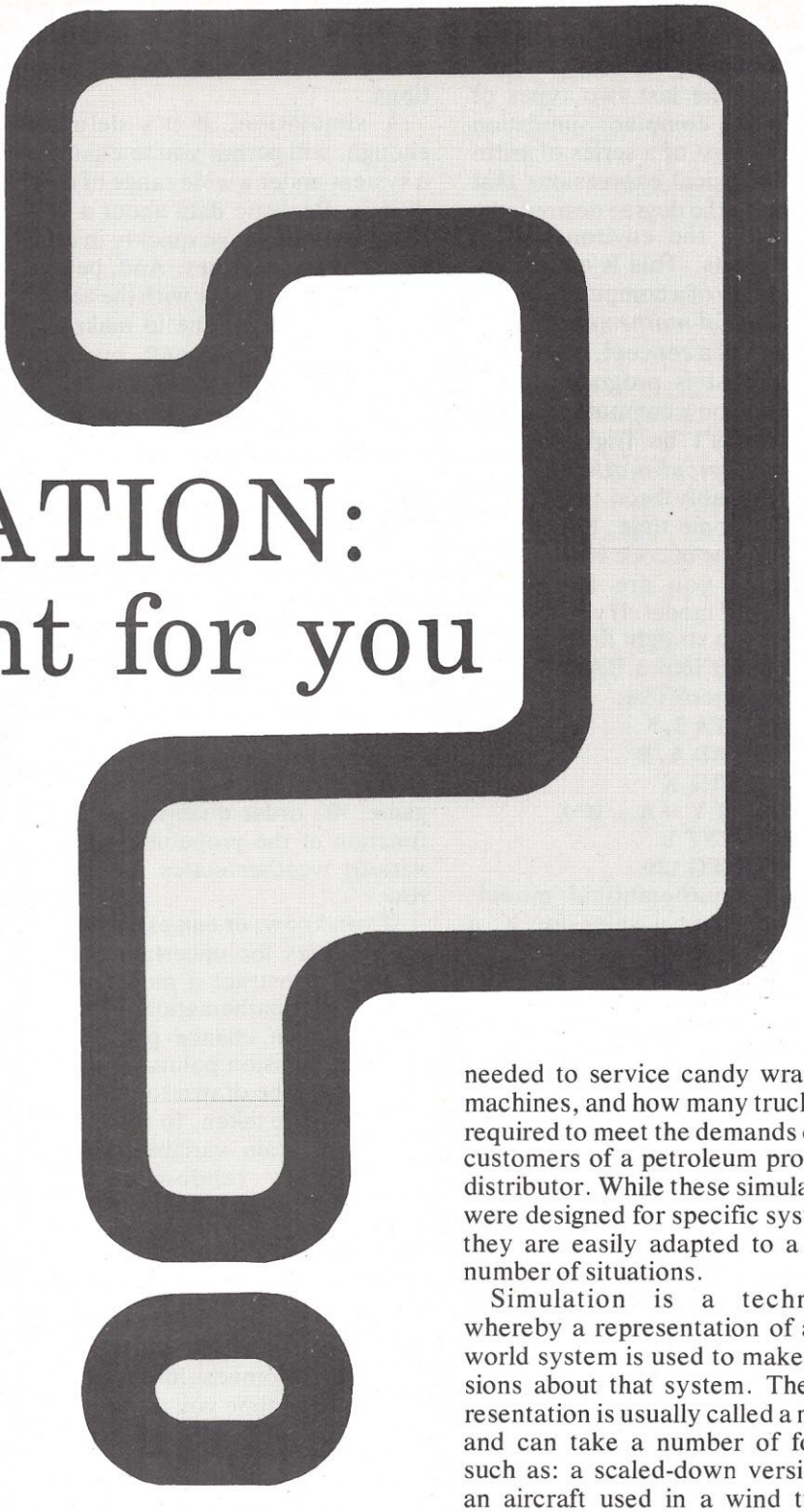

SIMULATION: Is it right for you

BY CHARLES J. WILSON

You say you've had your home computer for a while, you've overdosed on Black Jack and Star Trek, and now you want to use your wonderful machine to make some money. You've looked at the prices of printers, disks, and accounting package software, and it's going to run you six times the cost of your computer just to get started in business.

Is that what's troubling you, bunky? Well, wipe away those tears and put a smile on your face. Uncle Charlie's going to tell you how to make a few bucks with your computer as is.

The magic word is simulation. Simulation — the technique of creating a model of a problem situation and then using a computer to examine a wide range of alternatives — is an important technique in consulting. You're probably not quite ready to take on Booz, Allen & Hamilton, Inc., McKinsey & Co., or any of the other giants of the consulting world, but you can be a great help to your local grocer, doctor, banker, or other small businessperson. And this help should be worth more than just a few dollars.

I'm going to begin by discussing some of the basics of computer simulation. However, to keep you from being discouraged by the lack of an immediate practical application, I want to assure you that later in this series I'll be describing some living, breathing simulations that were used to solve problems for both big and small businesses. Among other things, you'll discover how frequently a doctor should schedule appointments, how many waitresses should be hired to work the dinner hour at the local diner, how any mechanics are needed to service candy wrapping machines, and how many trucks are required to meet the demands of the customers of a petroleum products distributor. While these simulations were designed for specific systems, they are easily adapted to a large number of situations.

Simulation is a technique whereby a representation of a real world system is used to make decisions about that system. The representation is usually called a model and can take a number of forms, such as: a scaled-down version of an aircraft used in a wind tunnel (Models of this type are referred to as physical models); A flow chart or decision table showing the relationships that exist and the steps that are to be taken should a given situation occur (This kind of model is called a procedural model); A set of equations that describe the change of and the interaction between the variables that are pertinent to the system (This type of model is known as a mathematical model).

Since it's unlikely that a majority of microcomputer owners are really

interested in a physical modeling system, I'm going to show you how to combine the last two types of models into a computer simulation that will consist of a series of arithmetic and logical expressions that represent, to the degree desired, the problem and the environment in which it exists. This is essentially one definition of a computer simulation: a *logical-mathematical* representation of a concept, system, or operation that is programmed for examination on a computer.

Please don't be frightened by the term *logical-mathematical*. You've probably been using these models for some time. Every time you write a line of code with an equation in it, you are building a mathematical model. If you take the equation for a straight line, y = a + bx, and put it into a BASIC program, it might look like:

```
100 DATA 2, 5
110 READ A, B
120 INPUT X
130 LET Y = A + B*X
140 PRINT Y
150 GOTO 120
```

This is a mathematical model. When you input a value for X, a value for Y is computed.

Suppose, depending on the value of X, a different equation is selected for computing Y. Now your BASIC program might be:

```
100 DATA 2, 5, 3, 7
110 READ A1, B1, A2, B2
120 INPUT X
130 IF X<10 THEN 160
140 LET Y = A1 + B1*X
150 GOTO 170
160 LET Y = A2 + B2*X
170 PRINT Y
180 GOTO 120
```

Now you have a logical-mathematical model.

Most of the simulations you will build to solve business problems will be a good deal more complex. But always remember that the underlying concepts themselves are not really complex.

A simulation provides a number of benefits. First off, you can use it to make decisions about a system at any point in the life-cycle of the system. If the system hasn't been constructed yet, you can use the simulation to make the basic decision as to whether to build it. If the decision is to build the system, the simulation can be used to optimize the design. If the system is already in operation, the simulation can be used to identify the causes of particular problems and to select the best solutions.

A simulation, if it's detailed enough, will permit you to examine a system under a wide range of conditions. Realistic data about a system can be obtained quickly in relatively large quantities. And, best of all, you don't tamper with the actual system until it is time to make the indicated improvement; business does not have to be interrupted. A final benefit is that a simulation is easily adapted to meet changing conditions or different applications.

As you put your model together, you will probably encounter some situations where uncertainty creeps in. For example, if you're using a simulation to help a football stadium vendor determine how many hot dogs to stock, weather conditions at game time will surely have an impact on sales. If orders for hot dogs have to be given to the wholesaler the night before the game, the order quantity will be a function of the probabilities of the various weather states for tomorrow.

If you know, or can estimate, the probabilities for uncertain events, you can construct a model where the logical-mathematical relationships contain chance parameters. At some decision points, a random number will be drawn to determine the path to be taken. In some equations, uncertain variables may be replaced by random numbers selected from appropriate distributions. This type of model is known as a stochastic model. Stochasticis a mathematical term meaning random.

A problem arises when you introduce randomness into your simulation. Each time you run the simulation, you will get a different answer, depending on the random numbers chosen at the various points in the model. This is what happens in your favorite game. Sometimes a Klingon ship can be destroyed with 300 units of energy and sometimes it takes 350 units. With a stochastic model, you will have to run the simulation a number of times and obtain a distribution of outputs. Your decisions are then based on the characteristics of the output distribution. This procedure of exercising the model a large number of times is called Monte Carlo simulation. An exact outcome is not predicted; instead, probabilities are assigned to the occurrence of the various outcomes.

If you don't want to consider all possible values for your uncertain variables, you can construct an expected value model. In this type of model, you deal only with the average value of the uncertain element. This average value is known as the mean or expected value. In this case, a given input will produce a given output. However, this is achieved at the expense of ignoring the consequences of the full range of possibilities.

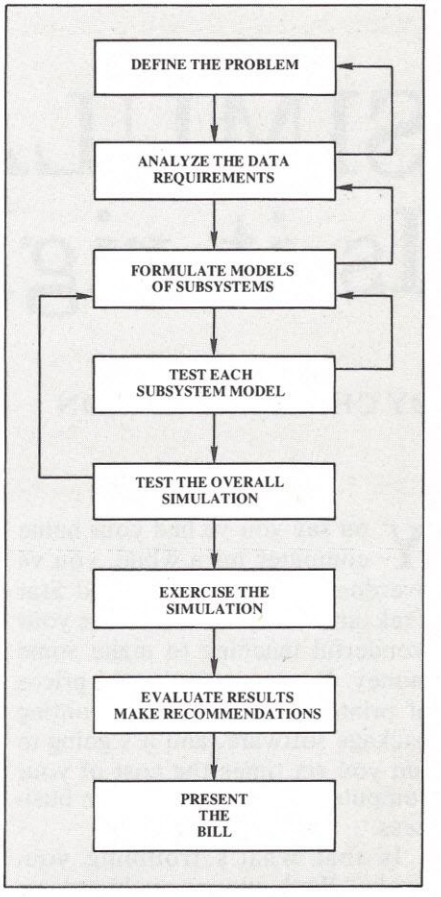

Figure 1. A flow chart for construction of your own simulation systems.

Suppose, for the system you're analyzing, that there is no uncertainty. At each point in the system, a given input produces a given output. A model of this type of system is called a deterministic model.

Simulations can be characterized by how time is measured. In your simulation, you, in most cases, will have to move your model through time, making sure that events occur in the proper order and at the proper time. There are two ways to describe the flow of time in a simula-

tion: equal time step and event time step. These two methods are sometimes called uniform-increment and variable-increment, respectively. Which step you use will depend on the system being modeled.

Under the equal time step method, the model is constructed so that it steps through time in equal increments. You should select a time step that is small enough that the possibility of a large number of events occurring during an interval is very low. If the time step is too large compared to the interval between the ocurrence of events, important details will be lost or smoothed beyond recognition. In the simulation, time is updated by the increment and a check is made to determine if an event occurred. If an event has occurred, all affected variables are updated, any necessary logic tests are made, and interactions are noted, the next time step is then made and the process is repeated. If you are simulating the daily cash balances of a firm, you would, of course, use an equal time step model with an increment no greater than one day.

In the event time step method, a prior determination of the times of occurrence of particular events is made and the simulation is moved in time from one event to the next in chronological order. The time step will be the interval between successive events and the time steps, in general, will not be equal. Again, at each time step, the required bookkeeping is performed and the pertinent variables are updated. If you are simulating the operation of a bank drive-in window, it would be most efficient to use event time steps, updating time on the arrival of a customer to the line of cars or on the completion of a transaction.

Models with equal time steps can be used to simulate any system. However, event time step models cannot be universally applied. They cannot be used, for example, where variables change in a continuous manner such as temperature in a chemical process.

In this section, I am going to discuss the steps that I generally follow in developing a simulation. However, you should be prepared to be flexible, since the number of steps and the order in which you perform them will be dependent to a large extent upon the particular situation with which you're faced. Even once you've defined the necessary steps, as the simulation evolves, you will probably return to and repeat earlier steps as additional information is obtained.

The steps listed below follow the flow chart shown in Figure 1. Note the many feedback paths indicating that earlier steps may be modified based on new information.

1. *Define the problem.* Discuss with the client the symptoms of the problem. Get your client to lay out in some detail exactly what the problem is, how it manifests itself, and what alternative actions are currently available and acceptable. Get the client to spell out the objective of the study. For example, the objective might be to reduce costs, increase profits, or reduce manufacturing process time. You'll need to know the objective to be able to choose between alternatives.
2. *Analyze the data requirements.* You are going to need data to build the simulation and to test it. So before you start, you should determine what data will be necessary, where it can be obtained, and in what form it must be. At this point, you should categorize the data into those which are variable and those which are constant, and into those that are determined within the system being investigated and those that are determined external to the system. Based on the availability of data, you may want to return to the client and reformulate the problem in terms that will permit a solution given the constraints of the available data.
3. *Formulate models of subsystems.* If you are dealing with a complex system, it is best to break it down into bite-size pieces and model each piece. This makes it easier to design the simulation, but it means your data needs are larger since you will require intermediate data to test each subsystem. Perhaps you should return to Step 2 and give some more thought to the data requirements.
4. *Test each subsystem model.* Compare the outputs of the simulation to the outputs of the system for each subsystem being modeled. Any deviation should result in a return to Step 3 for reformulation of the model.
5. *Combine the subsystem models into a single simulation of the overall system.* In Step 3, the system was broken into chunks. Now it's being put back together.
6. *Test the overall simulation.* Compare the performance of the simulation against the historical performance of the actual system. If the performance is not comparable, you will not be able to use the simulation to make reliable decisions relative to the problem being studied. You may have to go back to Step 3 in order to correct the model's deficiencies.
7. *Exercise the simulation.* Examine each alternative using the simulation. During this step (and earlier steps), you may uncover additional alternatives that are worth pursuing.
8. *Evaluate results and make recommendations.* Select the best of the alternatives examined or rank the alternatives for final selection by the client. The evaluation and recommendations should be professionally documented.
9. *Present the bill.*

I hope I've given you an easy-to-understand introduction to the world of computer simulation. For those of you who want to dig deper, I refer you the the bibliography listed below. For those of you who do not think an article of any value without a listing, keep an eye out for future installments describing actual simulations. Before then, however, our next article will deal in more depth with uncertainty, the basics of probability theory and how they may be applied to simulation. □

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DOS Commands in TRS-80 Level II BASIC

BY MEL PATRICK

I'm sure all of you know what happens when you give your TRS-80 a DOS command and you don't have a DOS system in memory. You immediately get a L3 ERROR message on the video monitor. You got that error message not because the computer didn't understand the command, but rather because the ROM told the computer to respond with that message anytime a DOS command was given and a DOS operating system wasn't present. However, there is a way to change these DOS commands to work to your advantage.

The ROM understands all the DOS commands and jumps to a DOS command entry table to either process or evaluate the information following the command. This DOS command entry table is located in RAM memory (the kind you can poke if you want to) at 4152H (16722 in decimal) to 41A5H (16805 in decimal). The DOS command table, entry point addresses in hex and decimal, and the addresses that the command jumps to (second and third bytes) is shown in Figure 1. The entry point addresses are not always loaded with the bytes shown in Figure 1, the exception being when you first power up the system and the computer finds a DOS system available. Obviously, if you have a DOS operating system you can't modify these addresses, otherwise you'll foul up your DOS commands.

Basics First

To use these DOS commands you are going to have to learn two things first — the "jump" command in assembler

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Figure 1 — DOS command entry points are all set to print out the "L3 Error" message when no DOS is present.

Hex Address	Command	Decimal Address	1st Byte	2nd Byte	3rd Byte
4152	CVI	16722,23,24	195D	45D	01D
4155	FN	16725,26,27	"	"	"
4158	CVS	16728,29,30	"	"	"
415B	DEF	16731,32,33	"	"	"
415E	CVD	16734,35,36	"	"	"
4161	EOF	16737,38,39	"	"	"
4164	LOC	16740,41,42	"	"	"
4167	LOF	16743,44,45	"	"	"
416A	MKI$	16746,47,48	"	"	"
416D	MKS$	16749,50,51	"	"	"
4170	MKD$	16752,53,54	"	"	"
4173	CMD	16755,56,57	"	"	"
4176	TIME$	16758,59,60	"	"	"
4179	OPEN	16761,62,63	"	"	"
417C	FIELD	16764,65,66	"	"	"
417F	GET	16767,68,69	"	"	"
4182	PUT	16770,71,72	"	"	"
4185	CLOSE	16773,74,75	"	"	"
4188	LOAD	16776,77,78	"	"	"
418B	MERGE	16779,80,81	"	"	"
418E	NAME	16782,83,84	"	"	"
4191	KILL	16785,86,87	"	"	"
4194	&	16788,89,90	"	"	"
4197	LSET	16791,92,93	"	"	"
419A	RSET	16794,95,96	"	"	"
419D	INSTR	16797,98,99	"	"	"
41A0	SAVE	16800,01,02	"	"	"
41A3	LINE	16803,04,05			

and how your TRS-80 stores addresses in memory.

Assembler language has over 700 instructions but, fortunately for us, we are only concerned with one. This is the jump instruction which is stored as C3 in hex or 195 in decimal. To understand the jump instruction a little easier you can think of it as a GOTO in Basic. It is followed by two bytes that are the addresses the computer will jump to. Again, this is much the same as a GOTO in Basic except, instead of a line number, the two bytes are an address located somewhere in the computer (remember the TRS-80 is memory mapped from 0000H to FFFFH).

These two bytes are stored the following way: the first byte after the jump instruction is the Least Significant Byte of the address, the second byte after the jump instruction is the Most Significant Byte of the address. The TRS-80 stores all addresses this way — LSB first, MSB second. For example, if we PEEKed three consecutive addresses in memory and they returned the values 195 00 9, anytime the computer jumped to the first address we PEEKed it would be instructed to jump to 0900. Remember the values we got when we PEEKed the computer are in decimal, you will have to convert them to hexidecimal to find the hex address. You will also have to reverse the LSB and MSB to get the address because of the way they are stored in memory.

All of the Basic commands and their entry points are listed in Figure 2. They are listed as command, hex address, decimal address and LSB/MSB bytes of the routine's address. These addresses may be in ROM or in RAM (like the DOS command entry points).

Getting It Together

Now that you know all the addresses and their entry points you can probably see some advantage in using them. For example, if you wanted to use the KILL command for NEW, you would poke the LSB into the KILL location then poke the MSB into the KILL location. Now, whenever you type in the KILL command, it will erase the resident Basic program. Note that the NEW command will still work as usual.

Another way you can use this idea is to change the CLOAD and CSAVE to LOAD and SAVE much like Microsoft Level III does. Still another way to use them would be to jump to a machine language program in high memory. This has an advantage over using USR(0) in that you can jump to different places in the program without

Figure 2 — Listing of entry points for Level II Basic commands.

Command	Hex Address	Decimal Address	LSB (Decimal)	MSB (Decimal)
ABS	0977	2423	119	9
AND	24FD	9725	253	37
ASC	2AOF	10767	15	42
ATN	15BD	5565	189	21
AUTO	2008	8200	8	32
CDBL	OADB	2779	219	10
CHR$	2A1F	10783	31	42
CINT	OA7F	2687	127	10
CLEAR	1E7A	7802	122	30
CLOAD	2C1F	11295	31	44
CLOSE	4185	16773	133	65
CLS	01C9	457	201	1
CMD	4173	16755	115	65
CONT	1DE4	7652	228	29
COS	1541	5441	65	21
CSAVE	2BF5	11253	245	43
CSNG	OAB1	2737	177	10
CVD	415E	16734	94	65
CVI	4152	16722	82	65
CVS	4158	16728	88	65
DATA	1F05	7941	5	31
DEF	415B	16731	91	65
DEFDBL	1E09	7689	9	30
DEFINT	1E03	7683	3	30
DEFSNG	1E06	7686	6	30
DEFSTR	1E00	7680	0	30
DELETE	2BC6	11206	198	43
DIM	2608	9736	8	38
EDIT	2E60	11872	96	46
ELSE	1F07	7943	7	31
END	1DAE	7598	174	29
EOF	4161	16737	97	65
ERL	24DD	9437	221	36
ERR	24CF	9423	207	36
EXP	1439	5177	57	20
FIELD	417C	16764	124	65
FIX	0B26	2854	38	11
FN	4155	16725	85	65
FOR	1CA1	7329	161	28
FRE	27D4	10196	212	39
GET	4174	16767	127	65
GOSUB	1EB1	7857	177	30

rePOKEing the LSB of the USR(0) function.

To use the DOS commands to jump to your routine, all you have to do is POKE in the LSB/MSB into the com mand entry point you want. Then, every time you issue that command, the program will jump to that command, and then to your machine language program. In fact, if you do any assembler programming, you can have your program load the command entry points with the entry point of your program. This is much faster than entering SYSTEM /entry point.

One more way you can use these addresses is a little different than you might expect. Unless you are running DOS you really don't even need those addresses that are reserved for DOS. This means that you now have free memory space from 16722 to 16805 for anything you want not taking anything away from regular programming area. I happen to have my Lower Case program sitting in that location leaving me with full memory for other programs.

If you load in a machine language program and want to use one of the DOS commands to branch to it and don't know the entry point of the routine, there is an easy way to find out by PRINT PEEK(16607), PEEK(16608). These two addresses contain the LSB/MSB of the entry point of the machine language routine. Then all you have to do is POKE those two addresses into whatever DOS command you want to branch there.

Remember that any time the computer returns the MEMORY SIZE? mode those DOS addresses will be reloaded with the original values (see Figure 1), so you will have to rePOKE them for your own use again.

Some of the DOS commands will return a SYNTAX ERROR when you use them to jump to a machine language program you have loaded in high memory. This is because of the RET instruction in your program. I have made a listing of the DOS commands in Figure 3 that you can use for anything and they will not return an error.

Even if you use the DOS commands to replace the regular Basic commands, the Basic commands will still work as usual. Some of the commands I commonly use are in Figure 4.

For further information see the Supermap by Fuller Software, 630 E. Springdale, Grand Prairie, TX 75051 and the Disassembled Handbook for TRS-80 by Richcraft Engineering Ltd., Drawer 1065, Chautauqua, NY 14722.

Figure 2 continued

GOTO	1EC2	7874	194	30
IF	2039	8249	57	32
INKEY$	019D	413	157	01
INP	2AEF	10991	239	42
INPUT	219A	8602	154	33
INSTR	419D	16797	157	65
INT	0B37	2871	55	11
KILL	4191	16785	145	65
LEFT$	2A61	10849	97	42
LEN	2A03	10755	3	42
LET	1F21	7969	33	31
LINE	41A3	16803	163	65
LIST	2B2E	11054	46	43
LLIST	2B29	11049	41	43
LOAD	4188	16776	136	65
LOC	4164	16740	100	65
LOF	4167	16743	103	65
LOG	0809	2057	9	8
LPRINT	2067	8295	103	32
LSET	4197	16791	151	65
MEM	27C9	10185	201	39
MERGE	418B	16779	139	65
MID$	2A9A	10906	154	42
MKD$	4170	16752	112	65
MKI$	416A	16746	106	65
MKS$	416D	16749	109	65
NAME	418E	16782	142	65
NEW	1B49	6985	73	27
NEXT	22B6	8886	182	34
NOT	25C4	9668	196	37
ON	1F6C	8044	108	31
OPEN	4179	16761	121	65
OR	25F7	9719	247	37
OUT	2AFB	11003	251	42
PEEK	2CAA	11434	170	44
POINT	0132	306	50	1
POKE	2CB1	11441	177	44
POS	27F5	10229	245	39
PRINT	206F	8303	111	32
PUT	4182	16770	130	65
RANDOM	01D3	467	211	1
READ	21EF	8687	239	33

Figure 2 continued

REM	1F07	7943	7	31	TROFF	1DF8	7672	248	29
RESET	0138	312	56	1	TRON	1DF7	7671	247	29
RESTORE	1D91	7569	145	29	USING	2CBD	11453	189	44
RESUME	1FAF	8111	175	31	USR	27FE	10238	254	39
RETURN	1EDE	7902	222	30	VAL	2AC5	10949	197	42
RIGHT$	2A91	10897	145	42	VARPTR	24EB	9451	235	36
RND	14C9	5321	201	20	&	4194	16788	148	65
RSET	419A	16794	154	65					
RUN	1EA3	7843	163	30					
SAVE	41A0	16800	160	65					
SET	0135	309	53	1					
SGN	098A	2442	138	9					
SIN	1547	5447	71	21					
SQR	13E7	5095	231	19					
STEP	2B01	11009	1	43					
STOP	1DA9	7593	169	29					
STR$	2836	10294	54	40					
STRING$	2A2F	10799	47	42					
SYSTEM	02B2	690	178	2					
TAB(	2137	8503	55	33					
TAN	15A8	5544	168	21					
TIME$	4176	16758	118	65					

Figure 3 — DOS commands that will work for anything.

Command	Decimal Address (LSB/MSB)
NAME	16783-16784
LSET	16792-16793
SAVE	16801-16802
LINE	16804-16805
MERGE	16780-16781
CLOSE	16774-16775
PUT	16771-16772
OPEN	16762-16763

Figure 4 — POKES I use after powering up the computer.

Change	To	
CLOAD	"	LOAD POKE 16777,31:POKE 16778,44
CSAVE	"	SAVE POKE 16801,245:POKE 16802,43
LPRINT	"	LINE POKE 16804,103:POKE 16805,32

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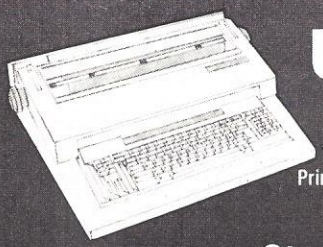

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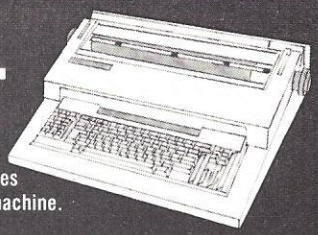

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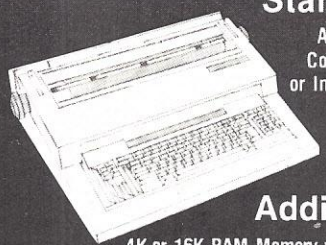

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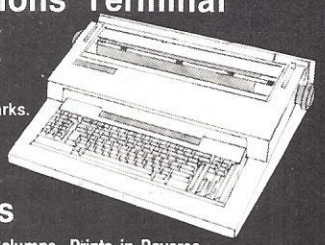

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Archimedes' Spiral

Archimedes, the famous Greek mathematician, was born in Syracuse, Sicily in 287 B.C., and was killed there in 212 B.C. when the city was sacked by the Romans. He has been immortalized for his research in mechanical physics and is perhaps best known for his statement in illustration of the principle of the lever and fulcrum: "Give me a place to stand, and I will move the world."

BY ROBERT KARIS

Archimedes' spiral is well known to doodlers, most of whom do not know its proper name or origin. The mathematical formula for it is simplicity itself: $R = t\Theta$ (the radius equals some constant times the angle). Being a part-time doodler myself, I was moved to investigate the possibility of the computer being able to emulate the master.

The program following is listed in *Applesoft*™ BASIC. Experimentation with it gives varied and visually pleasing results. Starting with a small angle of 6° and connecting the points, and not a continuous line, a larger angle of 17° gives the impression of a sun symbol or a Sea Anemone (Figure 2). Straight arms are obtained with an angle of 18°, and a slightly larger angle of 23° produces curved arms imitating sparkler wheels (Figure 3). With fewer arms (Θ=115°), the figure resembles a spiral galaxy (Figure 4).

Using lines instead of points, several more geometric figures may be produced. Θ=120° results in the production of triangles seen in Figure 5. A Θ of 90° produces squares (Figure 6), and the five-pointed star seen in Figure 7 is produced with an angle of 144°. If the angles are varied slightly, spiralling geometric forms may be generated (Figure 8, Θ=87.5°).

An X/Y ratio of 1:0.7 makes best use of the high resolution graphics screen in most cases. After each run is completed, and while the graphics are still on the screen, push RETURN to start again, or ESCape to stop. The program will operate with *Applesoft*™ in ROM or RAM.

Of course, I've listed only some of the possibilities here; there are many more variations to be explored on this same theme before either your interest or the computer is exhausted.

Figure 1

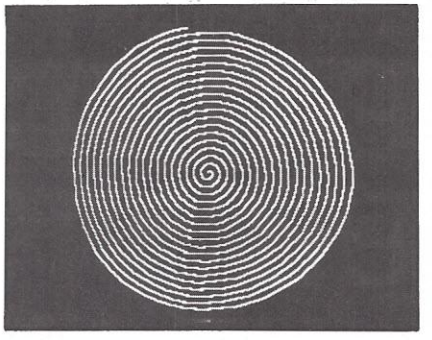


Figure 2

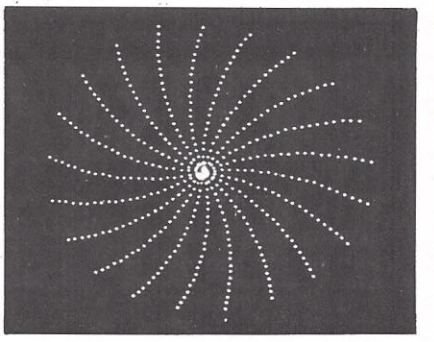


Figure 3

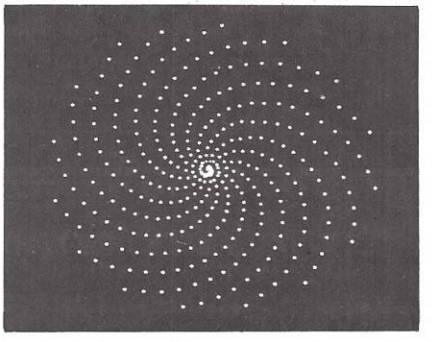


Figure 4

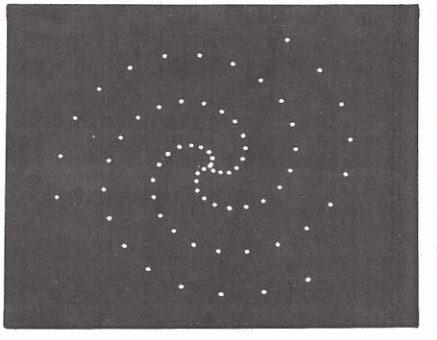


Figure 5

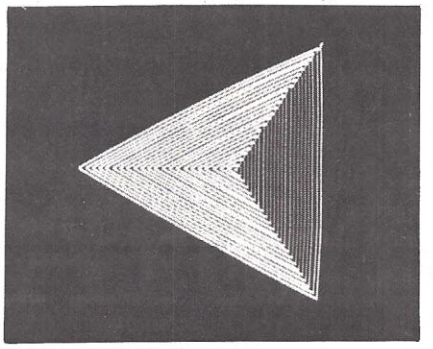


Figure 6

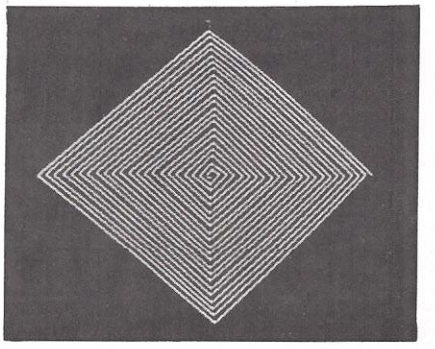


Figure 7

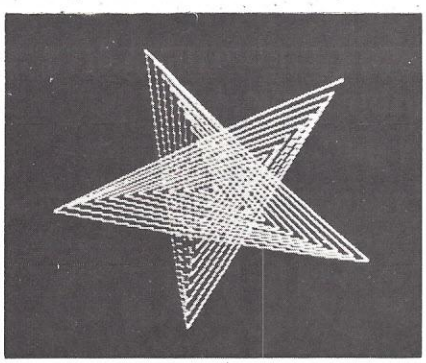
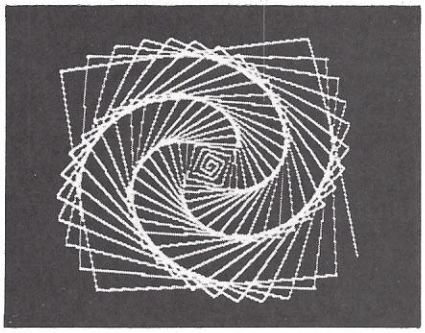


Figure 8



Program Listing

```
10  TEXT : HOME : VTAB 23: PRINT
     TAB( 6);"***** ARCHIMEDES S
    PIRAL *****": FOR DE = 1 TO
    2000: NEXT DE
20  PRINT : INPUT "SEPARATION OF
    POINTS IN DEGREES: ";D:D = D
     / 57.29578
30  PRINT : INPUT "DO YOU WANT DO
    TS (D) OR LINES (L): ";S$
40  PRINT : INPUT "RELATIVE  LENG
    THS OF X AND Y.  STANDARD LE
    NGTHS : 1,1   X,Y : ";A,B
50  PRINT : PRINT "PUSH 'RETURN'
    TO CONTINUE PROGRAM, 'ESC' T
    O QUIT. ";: GET Q$: IF  ASC
    (Q$) = 27 GOTO 150
60  HGR2 : HCOLOR= 3: HPLOT 140,9
    6
70  FOR R = 0 TO 200 STEP D
80 X = R *  COS (R):Y = R *  SIN
    (R):X = X * A:Y = Y * B
90 X = X + 140:Y = Y + 96: IF X <
    0 OR X > 280 OR Y < 0 OR Y >
    192 GOTO 140
100  IF S$ = "D" GOTO 120
110  HPLOT  TO X,Y: GOTO 130
120  HPLOT X,Y
130  NEXT R
140  GET Q$: IF  ASC (Q$) = 13 THEN
      TEXT : HOME : VTAB 23: GOTO
     20
150  TEXT : HOME : VTAB 23: END
160  REM  ARCHIMEDES SPIRAL
170  REM  R. KARIS 8/80
```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CIRCLE 22

Estimating Construction Material Costs

BY DAVID D. BUSCH

The applicability of problems for computer solution can fall into two general categories. Some tasks simply beg for a computer's aid: clear-cut algorithms with some inputs, a lot of number crunching, and neat, predictable output, preferably arranged in columns. Other jobs ask the computer to emulate a human's thought process to solve a problem. Here, the programmer's chore is not so much of defining the problem, but in coming to a better understanding of human intelligence.

Clearly, the latter is more challenging, but even the simple algorithm-type problem can undergo some interesting enhancements. FRAMEUP is a simple little program that provides a hint of what computers can do towards enhancing a human's approach to design.

FRAMEUP provides the home handyperson with a quick means of estimating materials usage and cost for a common home remodeling job, such as framing and finishing a square or rectangular room inside an existing structure. It will estimate how many 2 X 4's, 4 X 8 foot sheets of paneling or wallboard must be used, and how many 9 or 12-inch square floor tiles should be purchased. Carpeting or vinyl flooring can be substituted, and is estimated in square yards.

The program makes certain assumptions. First, it assumes that the carpenter will be using eight-foot long nominal 2 X 4-inch lumber for the framing, with top and bottom plates all around, and studs placed 48-inches apart. Standard 4 x 8 paneling or gypsum board is taken for granted to fit 8-foot ceilings. Either 9-inch or 12-inch square floor tiles, or roll floor covering must be used. It is assumed that windows and doors will be prehung, (or pre-existing) and installed in holes cut in the paneling.

Walls in the long and short dimensions are identical, so the material required for each is figured once, and then doubled. Fractions are rounded to the next highest integer by taking the INT value of the number, plus 0.9, as in Line 660. However, in figuring the number of wall panels required, the program determines the number of whole panels by dividing the wall's length by 48-inches, and then allocating the remainder to a partial panel. The program doesn't attempt to decide if leftover pieces from one wall can be cut to fit one of the others. Instead, the size of these "leftover" pieces is listed, and the user can readily see if they can be cut from one or more whole panels. In calculating costs, the program assumes that each leftover will be cut from a full piece of wallboard or paneling.

This type of rough estimate will automatically include a small amount of "extra" material of the sort that all but the most proficient woodworkers count on to make up for mistakes, bad measuring or cutting, and so forth. The user should gauge his/her own skill, and add a "fudge factor" of spoiled material accordingly. Not only are panels and 2 x 4's miscut, but floor tiles become frequent victims.

The program is fairly simple. It asks the user to input the needed information, such as dimensions of the room, costs of the materials, and the type of flooring that will be used. Then, basic arithmetic is used to calculate the number each material required.

Because of the simplicity of the algorithm, no special BASIC statements were needed for FRAMEUP. PRINT USING is employed to tidy

Sample Run

```
This program will calculate rough materials usage to frame
and finish a square or rectangular room with 8-foot ceilings.
 It assumes you will be using eight-foot 2 x 4's for framing,
 and standard 4 x 8 foot wallboard or paneling.
 In calculating the number of wall studs, 48-inch centers
 are used, and an extra stud allowed per wall per corner.

Enter length of room in feet,inches :? 20,6
Enter width of room in feet, inches :? 14,8
Enter cost each of 2 x 4 x 8 lumber :? 1.59
Enter cost each of 4 x 8 paneling or wallboard :? 8.99
←

Will floor be covered with      1.) Floor tile
                                2.) Carpet
                                3.) Linoleum

     Enter choice :  ? 1

 Will you be using 9-inch or 12-inch tiles ? 12
 Enter cost each of tile (use $ 0.00 ):? .59
 Are the tiles self-stick  (Y or N ) ? N
 Enter coverage of adhesive in square feet per gallon :? 200
 Enter cost of adhesive per gallon :? 5.99

 Minimum materials needed :
 Eight-foot 2 x 4's :          36              $57.24
 Whole sheets of paneling :    16             $143.84
 Plus two partial sheets :     6  in. wide     $17.98
 Plus two partial sheets :     32  in. wide    $17.98
 Tiles  12  in. square needed: 301            $177.59
 Gallons of adhesive needed :  1.50333          $9.00
 Total costs :                                $423.63
```

Program Listing

```
10 '****** FRAME-UP ******

20 '   DAVID BUSCH
       515 E. HIGHLAND AVENUE
       RAVENNA, OHIO 44266

30 F$="$$#####.##"
40 CLS:PRINT:PRINT
50 PRINT "This program will calculate roush materials usage to frame"
60 PRINT"and finish a square or rectangular room with 8-foot ceilings."
70 PRINT " It assumes you will be using eight-foot 2 x 4's for framing,"
80 PRINT " and standard 4 x 8 foot wallboard or paneling."
90 PRINT " In calculating the number of wall studs, 48-inch centers"
100 PRINT " are used, and an extra stud allowed per wall per corner."
110 PRINT:PRINT
120 INPUT "Enter length of room in feet,inches :";F,I
130 L=F*12+I
140 INPUT"Enter width of room in feet, inches :";F,I
150 W=F*12+I
160 SI=L*W
170 INPUT"Enter cost each of 2 x 4 x 8 lumber :";TW
180 INPUT "Enter cost each of 4 x 8 paneling or wallboard :";WB
190 ' ****** CALCULATE FLOOR COVERING NEEDED ******

200 CLS:PRINT:PRINT
210 PRINT "Will floor be covered with     1.)  Floor tile "
220 PRINT "                               2.)  Carpet"
230 PRINT"                               3.)  Linoleum"
240 PRINT
250 INPUT "      Enter choice :  ";CH$
260 FL=VAL(CH$):IF FL<1 OR FL>3 GOTO 250
270 ON FL GOTO 280,510,510
280 CLS:PRINT:PRINT
290 INPUT"Will you be using 9-inch or 12-inch tiles ";TS$
300 TS=VAL(TS$)
310 IF TS=9 GOTO 340
320 IF TS=12 GOTO 340
330 GOTO 290
340 TILE=TS*TS
350 CLS:PRINT:PRINT
360 INPUT"Enter cost each of tile (use $ 0.00 ):";TC$
370 CLS:PRINT:PRINT
380 INPUT"Are the tiles self-stick  (Y or N ) ";AN$
390 IF LEFT$(AN$,1)="N" THEN INPUT"Enter coverage of adhesive in square feet per gallon :";AD$
400 CLS:PRINT:PRINT
410 INPUT"Enter cost of adhesive per gallon :";AC$
420 AD=VAL(AD$)
430 AD=AD*144
440 AN=SI/AD
450 TN=SI/TILE
460 TN=INT(TN+.9)
470 TC=VAL(TC$):AC=VAL(AC$)
480 TC=TC*TN
490 AC=AC*AN
500 GOTO 580
510 CN=SI/1296
520 CLS:PRINT:PRINT
530 INPUT" Enter cost per square yard of carpet or linoleum :";CC$
540 CC=VAL(CC$)
550 CC=CC*CN
560 CN=INT(CN+.9)
570 ' ****** FIGURE PLATES AND STUDS FOR WALLS ******

580 P1=L/96
590 P1=INT(P1+.9)*2
600 P2=W/96
610 P2=INT(P2+.9)*2
620 PLATES=P1+P2
630 W1=L/48
640 W2=W/48
650 STUDS=W1*2+W2*2+8
660 STUDS=INT(STUDS+.9)
670 SC=STUDS*TW:PC=PLATES*TW
680 LC=SC+PC
690 ' ****** FIGURE PANELS NEEDED ******

700 H1=INT(W1)
710 L1=L-(H1*48)
720 H2=INT(W2)
730 L2=W-(H2*48)
740 PANELS=H1*2+H2*2
750 WC=PANELS*WB
760 ' ****** DISPLAY RESULTS ******

770 CLS:PRINT:PRINT
780 PRINT "Minimum materials needed :"
790 PRINT
800 PRINT "Eight-foot 2 x 4's :";:PRINT TAB(30);PLATES+STUDS;:PRINT TAB(45)"";:PRINT USING F$;LC

810 PRINT "Whole sheets of paneling :";:PRINT TAB(30);PANELS;:PRINT TAB(45)"";:PRINT USING F$;WC

820 IF L1 <>0 PRINT"Plus two partial sheets :";:PRINT TAB(30)L1;" in. wide";:PRINT TAB(45);"";:P
A=2*WB:PRINT USING F$;PA
830 IF L2<>0 PRINT"Plus two partial sheets :";:PRINT TAB(30)L2;" in. wide";:PRINT TAB(45)"";:PB=
2*WB:PRINT USING F$;PB
840 XC=PA+PB
850 IF CN <> 0 AND FL=2 THEN PRINT "Square yards of carpet   :";:PRINT TAB(30)CN;:PRINT TAB(45)"
";:PRINT USING F$;CC:GOTO 890
860 IF CN <> 0 AND FL=3 THEN PRINT  "Square yards of linoleum :";:PRINT TAB(30)CN;:PRINT TAB(45)
"";:PRINT USING F$;CC:GOTO 890
870 PRINT "Tiles ";TS;" in. square needed:";:PRINT TAB(30)TN;:PRINT TAB(45)"";:PRINT USING F$;TC

880 IF AN <> 0 THEN PRINT "Gallons of adhesive needed :";:PRINT TAB(30)AN;:PRINT TAB(45)"";:PRIN
T USING F$;AC
890 TT=LC+WC+XC+CC+TC+AC
900 PRINT
910 PRINT "Total costs :";:PRINT TAB(45)"";:PRINT USING F$;TT
920 GOTO 920
```

up the video display, but the program should be operable on most BASICs as is.

Possibilities for enhancements abound. No provision was made for estimating materials cost for ceilings because of the many types of ceiling construction available; suspended or otherwise. A subroutine could be written to compare the leftover pieces of wallboard with the gaps in other walls, and determine the most efficient means of cutting the sheets. Another subroutine could use National Electrical Code guidelines for spacing of electrical outlets to provide recommendations for placement of the outlets, and calculation of the costs for wire, junction boxes, switches, outlets, etc.

Glue for paneling and nails for framing could also be estimated fairly closely, along with baseboards and trim strips. Applications for a sophisticated version of FRAMEUP could range from the home carpenter using the program to decide whether or not the family can afford to finish off the attic, to a professional using similar techniques to estimate remodeling costs. □

MOST IMPORTANT VARIABLES USED IN FRAMEUP

AD	Adhesive coverage in square feet per gallon
AN	Amount of adhesive needed in gallons
CC	Final cost of carpet or linoleum
CN	Amount of carpet or linoleum needed in square yards
F	Feet, dimension of room input by user
FL	Stores flag indicating floor covering choice
H1	Number of whole panels needed for long dimension
H2	Number of whole panels needed for short dimension
I	Inches, input by user
L	Length of room in inches
L1	Leftover inches not covered by full panels, long dimension
L2	Leftover inches not covered by full panels, short dimension
LC	Lumber cost
P1	Number of 2 x 4's to span long dimension
P2	Number of 2 x 4's to span short dimension
PANELS	Number of full 4 x 8 foot panels needed
PLATES	Number of 1 x 4's needed horizontally
SI	Floor area in square inches
STUDS	Number of 2 x 4's needed vertically
TC	Tile cost
TILE	Area of one tile in square inches
TN	Number of tile needed
TS	Length of one side of one tile
TT	Total cost of all materials
TW	Cost of each 2 x 4, input by user
W	Width of room in inches
W1	Number of 48-inch spans in long dimension
W2	Number of 48-inch spans in short dimension
WB	Cost of each sheet of paneling
WC	Total paneling/wallboard cost
XC	Cost of leftover panels

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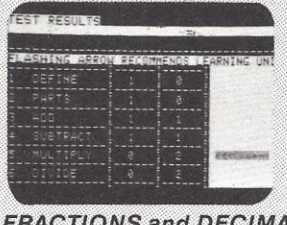

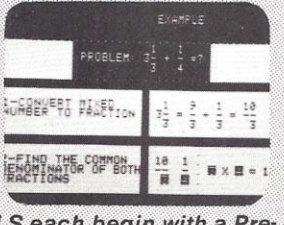

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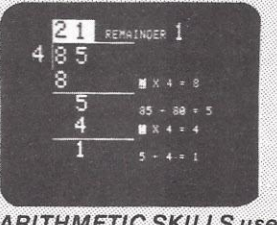

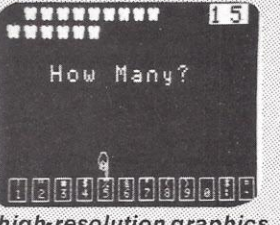

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CIRCLE 23

The Eleventh North American Computer Chess Championship

BY EVAN KATZ

Computer chess met country music recently at the annual NACCC held in Nashville, Tennessee, October 26-28. The tournament, as part of the 1980 Annual Conference and Exposition of the AMC, was held at the gorgeous Opryland Hotel, adjacent to the famous Grand Ole Opry, and featured ten strong chess competitors.

There was a great diversity of computer strength amongst the programs and three of them were actually microcomputers brought to the tournament. *Belle*, which had just captured the World Computer Championship in Linz, Austria by defeating *Chaos* in a tie-breaking game, was the favorite and *Chaos* was seeded second.

A great disappointment to all was the withdrawal of the *Duchess* and *Chess 4.9* programs which had finished second and third at the World Championship, respectively. It was reported that Tom Truscott could not secure machine time for *Duchess,* (which has competed in the last six ACM competitions) and Dave Cahlander, the *Chess 4.9* representative from Control Data Corp. (CDC), took ill in Europe. Earlier versions of 4.9 had won eight out of the last ten ACMs.

The microcomputer program *Boris Experimental,* entered by Applied Concepts (the makers of the Modular Game System) was also withdrawn. As it turns out, the program might have been barred anyway. Kathe Spracklen (of *Sargon* fame) now working for Fidelity Electronics, argued that *Boris Experimental* was too similar to her *Sargon 2.5* and demanded that the Tournament Organizing Committee compare source codes. Applied's chief chess programmer, John Acker, acknowledged that *Experimental* was a revamped *Sargon 2.5* but couldn't say exactly how much of the old program remained.

Many of the rules and the people were retained from previous years, but several exciting additions were made, such as the First ACM Computer Chess Championship.

Ben Mittman from Northwestern University, and McGill University's Monty Newborn composed the Selection Committee which made these seedings based upon past performance of the programs, updates to the algorithms and new specifications:

1. *Belle* 2. *Chaos* 3. *Cray Blitz* 4. *Bebe* 5. *Awit* 6. *Mychess* 7. *Ostrich 81.* 8. *Cube 2.0* 9. *Chess Challenger* 10. *Clash.*

Panelists and audience of the 1980 Computer Chess Technical Session. From left: David Levy, tournament director; Bob Hyatt, Cray Blitz; Kathe Spracklen, Chess Challenger; Ben Mittman, chairman; Tony Scherzer, Bebe; Fred Swartz, Chaos; Ken Thompson, Belle; and Monty Newborn, Ostrich '81.

The two veterans were joined by Bob Hyatt from the University of Southern Mississippi and John Thatcher from Vanderbilt University to form the Tournament Organizing Committee. David Levy, International Master and computer chess author, was Tournament Director and Master of Ceremonies.

The jovial, good nature of the participants and organizers complemented the wonderful hospitality of the Tennesseans. Have no qualms about writing a programmer with comments or congratulations. In most cases, they'll be glad to personally answer brief questions and help you in response to more general inquiries.

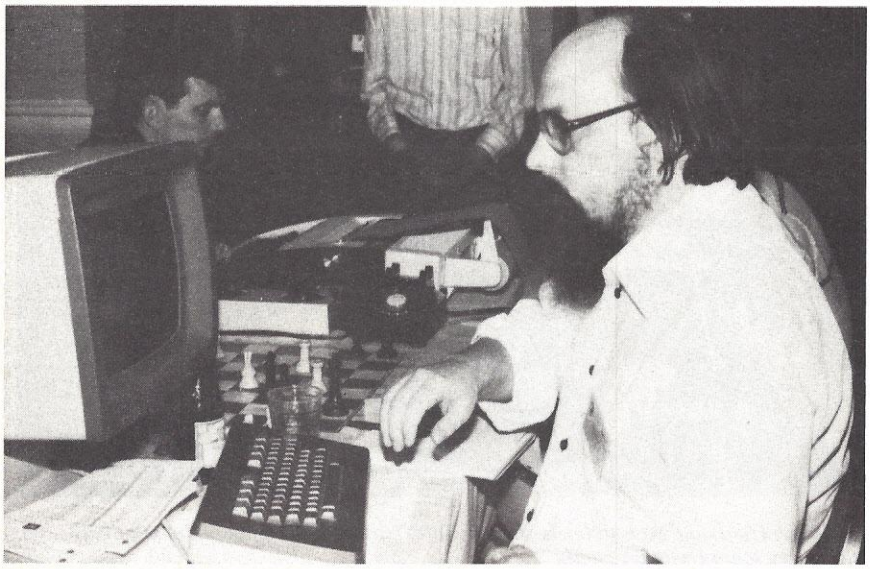
Regular, "human" rules were used for the four-round Swiss competition with Levy having the final decision on all points of contention. The time control was 40 moves per side in the first two hours and 10 moves every 30 minutes thereafter. Each team could take up to two, 20-minute timeouts and reset program parameters if it encountered technical difficulties. A new stipulation was the requirement of manual chess clocks. While the machines could be reset in the event of a power loss, electronic clocks could not. Therefore, Bob Hyatt had to rig a manual clock to work with the *Blitz* electronic board. As usual, tournament director Levy could adjudicate a game after four and a half hours of play. Important, though, was the fact that a game would be adjourned on position alone; whether any program could possibly win the contest was to make no difference.

Blitz, running on the Cray 1, the world's fastest computer, was to enjoy a speed improvement of a factor of 80 when compared to its old host machine, the Sigma 9. Cray President John Orlwagen, according to Hyatt, is quite excited about computer chess and enjoys it a great deal. Now searching a full seven ply in the middlegame, (vs. the five ply achieved last year) *Blitz* achieved 30% hashing in the middlegame and up to 80% hashing in the endgame. According to its author, *Blitz* has an "evaluation that is extremely

Chris Peters (left) and Monty Newborn chat while Ostrich contemplates its next move (7 ... e6). David Levy scans the other games.

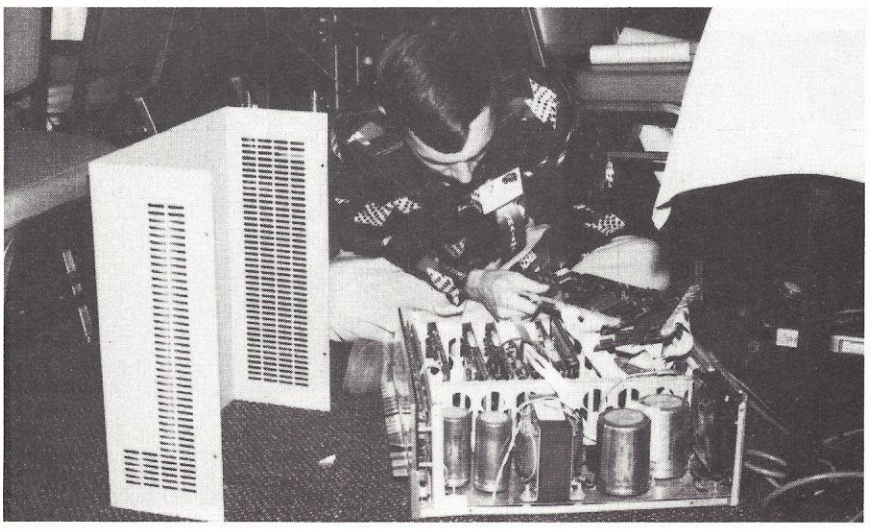
A multitude of spectators watch the exciting Challenger-Belle game for the championship. Ron Nelson, a Fidelity chess programmer for years, stands between Kathe and Ken.

Dan and Kathe Spracklen smile as Challenger has Belle on the ropes threatening to defeat the world champion!



Ken Thompson, a picture of confidence, studies Belle's analysis during its second round game with Cray Blitz.

Dan and Kathe Spracklen, the champions of microcomputer chess. If Fidelity gives them the same hardware and memory for the commercial game, watch out 1700s!



Bob Hyatt working on his Cromemco hardware that controls Cray Blitz's electronic sensory board.

sophisticated" and "adapted to the art of attacking the opponent's king." It performs a quiescent search of captures and checks which are even or better, and supposedly has a good understanding of when pawns are unstoppable in the endgame.

Belle is now completely self-contained, and came to the tournament looking like a small telephone booth. Replete with a meter which shows how quickly the search is progressing, Belle was an aesthetic wonder as well. As stated by Monty Newborn, "We're glad he's here and we're out to get him!"

Contrasting in appearance as well as strength was Chris Peters' *Clash,* which was in several parts with wires flowing from all over. Although the program lost every game, it came close to "victory" as its exposed circuits nearly gave several passersby the shock of their lives. It is interesting to note that *Clash* plays the opening better with a small search and that Peters has it looking one ply only on the first three moves. Because its computer doesn't possess fantastic speed, *Clash* uses static exchange evaluation, as did *Sargon II,* and a killer heuristic to find quick refutations.

The *Mychess* entry, run by Mark Gorelnik, this writer, and the author's friend, Dave Kittenger, will be marketed in 1981 as a stand-alone game. The device, sporting approximately 24K and a 6 MHz Z-80 chip, will be shown at the January Consumer Electronics show. Improved slightly over last year, *Mychess* ran from EPROM on-site.

The most significant entry for the average chess player was *Chess Challenger.* It must be made perfectly clear that what played at the ACM and what is being sold as *Sensory Voice Challenger,* contain totally different programs and hardware.

The *Challenger* which competed is the work of Dan and Kathe Spracklen, probably the best and most creative microcomputer chess programmers, while the game actually being sold is not. The former ran on a super-fast 4.0 MHz 6502

processor, effectively much faster than the Z-80 chip which runs the commercial game. In fact, the computer required a cooling unit four times the size of the game itself! It also thought on the opponent's time while the Challenger for sale does not. The next generation of Fidelity chess computers to be marketed around the fall of next year will tell how many ply they have searched, as the ACM machine did. The Spracklens, who were achieving five ply in the middle game and up to eight in the endgame, report a 10% search improvement since the tournament.

The Spracklens set *Challenger's* window at +/- one third of a pawn, which can be exceeded by a passed pawn. Bishops are given slightly greater weight than knights.

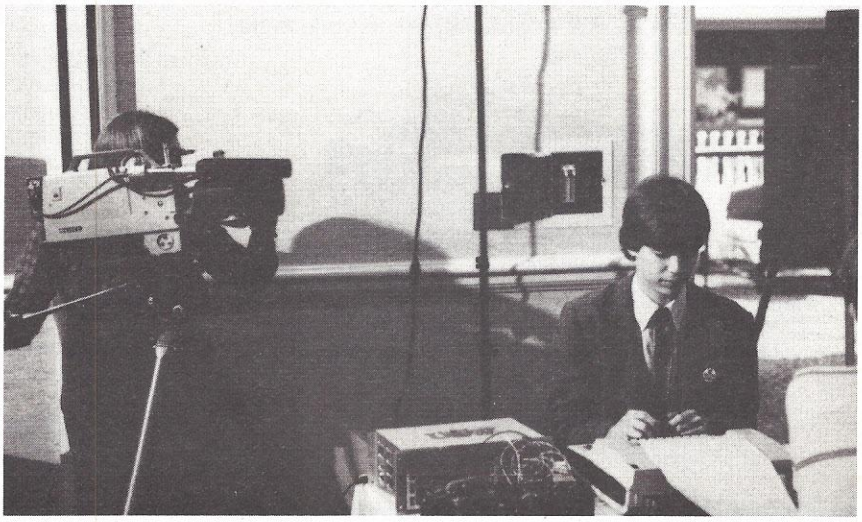
Each round was an exciting event composed of five heated battles. David Levy, although plagued by a sore throat, added enlightening comments on the games in progress, both from a programmer's and chess player's point of view. In contrast with human tournaments, the spectators were able to speak among themselves and call out ideas to Levy. The authors also contributed thoughts—their own and those which their machines printed out.

Ostrich, in its game with *Chaos,* goofed on move five with Nxc6. This same mistake in the Sicilian, letting black recapture to the center while gaining the b-file, was made by *Chess 4.7* in its famous match vs. Levy, who would intentionally create a position where 4.7 could blow it. Beginning programmers should note that the move *does* give black an isolated pawn; it's tough to balance positional factors! When *Ostrich* followed with passive, imprecise play, *Chaos* smothered it until Monty Newborn resigned for his program on move 24.

Cray Blitz vs. *Cube* was unique in that it was the "highest-powered" chess game to date. The two combatants were performing a total of 160,000,000 instructions per second! The game ended abruptly, however, when *Cube* encountered uncorrectable machine trouble and

Round #1 gets under way. With the programs playing the first dozen moves or so out of their opening books, the action is fast and furious.

The Spracklens chat with Tony Scherzer (seated right) and friend.



Chris Peters and Clash make the airways.

had to resign, admittedly in a bad position. *Blitz's* tenth move (0-0) was made based on an eight-ply search taking 55 minutes (while *Cube* was down). It was *Cube*'s first tournament and things did not run smoothly. The program also suffered from a fifteen second communications delay as data from Nashville first went to a toll-free number then to an Apex, to a Cyber 175, to a live concentrator and then finally to the Cray. Lloyd Lank, *Cube's* author, promises to be back next year with a better program.

Challenger chose to play positionally vs. *Bebe*'s Sicilian Dragon. David Levy commented that *Bebe* exhibited a "deep understanding" of the Sicilian through move 15. After some indecisive moves, it was later able to win a pawn but could make nothing out of it. *Challenger* examined six ply after queens were exchanged, and examined eight on move 28 in 4:24! And to think that *Sargon* could only get three last year! *Bebe,* which was searching seven ply, allowed 16 seconds for the I/O of moves, a typical "fudge factor" for slow human execution. The combatants reached a drawn endame at move 55.

Most of the audience were ACM members, but there were also many computer chess addicts, chess fanatics and reporters. The display boards were manned by volunteers from a local Nashville chess club who performed admirably, even when the programs were zipping off moves from their opening books.

At the contestants' meeting just before the start of round one, the only question posed dealt with the running of the speed competition. It was finally decided to give each program an average of five seconds of CPU time per move until the game ended. Thinking on the opponent's time, (or pondering as the programmers call it) would be allowed. Since there were only ten programs, a round robin tournament format was selected. In addition to giving each program a chance to meet all the others, a round robin tournament would allow the programmers to face off whenever they chose to.

Even though the weaker programs have made large, quantum advances, the first round pairings which pit the top half against the bottom half (one vs. six, five vs. ten, etc.), resulted in four wins for the favored side. The fact that *Challenger* drew *Bebe* is accounted for by the low seeding given the Fidelity unit as a result of its poor performance at the World Championship in Linz, Austria. But *Challenger*'s lapse in Linz was caused by a bug which allowed tables to overlap; the program which was supposed to finish ninth nearly won and finished in third!

(continued next month!)

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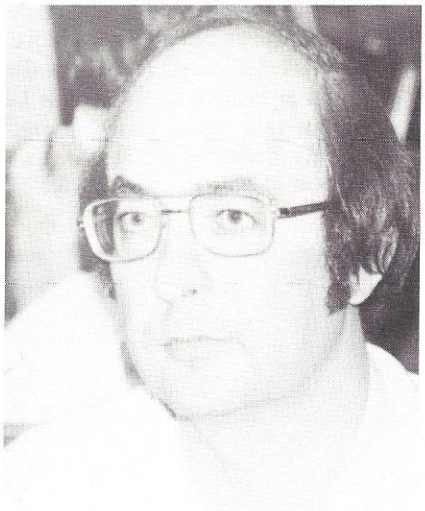
CIRCLE 35

By HARRY SHERSHOW

Two New Units In Action

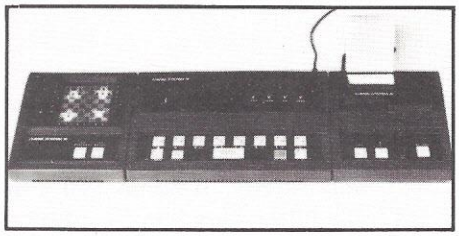
In the second round of the U.S. Microcomputer Chess Tournament at San Jose, Tryom's "Chess Champion Super System III" and BORIS "X" (experimental) staged a hard fought game which ended in a draw. While the two units were at each other's throats, John Aker, who was running BORIX "X", found a few minutes to answer some of our questions.

Q. Do you work for Applied Concepts, John?
A. Well, yes and no. I'm a consultant for them but work out of my own laboratory in Shawnee, Kansas —right outside Kansas City. I am an independent consultant. I do all my work at my place because I have all the equipment I need right there.
Q. Are you the programmer of this BORIS "X" unit?
A. Yes I am.
Q. Is that the name that will be used when the unit gets on the shelves?
A. I think Applied is planning to call it something else besides "X". They'll probably name it after some legendary chess figure. It all depends on the capabilities of program "X" and whether we decide to incorporate those capabilities into the final program. At this time that's still unknown and so is the new game. (Shortly after this interview, Applied Concepts announced that the name for its new module would be MORPHY—ed.)
Q. Will you compare BORIS "X" to BORIS 2.5? The 2.5 has practically become a standard. People describe their own programs in terms of how well they perform against 2.5. Can they beat it? Does it lose to 2.5? Is it a standoff? You need a parameter in computer chess. It looks now as though 2.5 has become that parameter. You can now compare all the programs on the market against 2.5 and depending on how they perform you have a pretty good idea of how they all play.

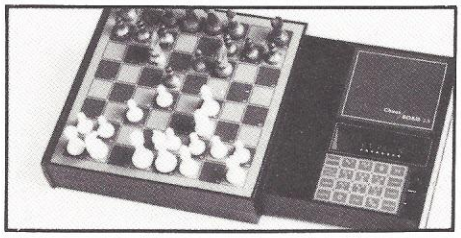


John Aker, designer of the Modular Game System (who also wrote the Boris X program) was on hand to run the Applied Concepts unit.

A. Yes. I agree that it's important to have a standard against which you can measure other programs. Until we have a good method of arriving at computer-chess ratings, such comparative evaluations work well. The difference between BORIS "X" and BORIS 2.5 is an improvement in the time factor. BORIS "X" will basically play the same moves that 2.5 plays but will play them in considerably less time. Pierre Nolot, the French journalist who came from Paris to attend this tournament, tested some problems on the two units. BORIS "X" solved the problems four times faster than BORIS 2.5. There are other improvements in the program also, but I can't go into them right now. Such information should probably come from the company. But obviously this unit has some strong improvements over 2.5. Otherwise, we wouldn't be here.
Q. How about some comments on the games played so far at this tournament?
A. Well, BORIS "X" looks deeper into the ply search in a given period of time. It thinks on your time and because of that economy it can go up to ply five, six or maybe seven. At this time, in this particular game, I am in a situation where I have lots of time over Tryom. Their unit is a constant-time-interval type. It plays every move the same length of time regardless of the tactical situation. Right now, for example, BORIS "X" has anticipated Tryom's next move and when I finally enter Tryom's move my pro-



Tryom's "Chess Champion Super System III" plays White vs Applied Concepts' "BORIS X" playing Black



gram will respond almost immediately because it's already completed the required amount of search needed for a level four move—which is the level we're playing at. However, since I've got plenty of time I'm simply not entering that move. My hope is that the machine will use the extra time to pick the next response out of a seven ply search rather than a four ply search.

Q. How many plies can BORIS "X" search?

A. BORIS "X" is similar to 2.5 and both will search up to ten plies in the end game. It depends, of course, on the number of nodes it can investigate. In ply six, for example, it will do a complete search at that ply no matter how long it takes. And the time control will cause the unit to go up a ply. If it hasn't investigated the minimum number of nodes then it will automatically increase the maximum depth of investigation by one ply search if it is thinking on your time. Until you move it will continue to increase the ply depth to a maximum of two plies past what you have it set for.

Q. What is the maximum number of plies BORIS "X" has searched?

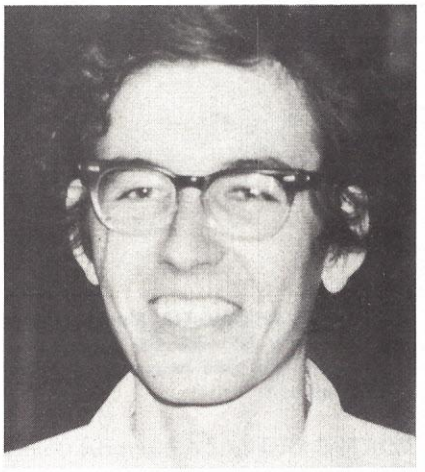
A. It will do about ten plies. But it has to be a relatively simple situation to reach the ninth or tenth ply and there can't be too many pieces on the board. As you move up a ply there is such an astronomical explosion of nodes that there is a limit on how far you can go.

Q. I notice that BORIS "X" has no comments in its display like other models.

A. Yes. The comments on this unit, unlike the other 2.5 units have been eliminated. Whether or not it will stay that way is a decision that will be made later. In this model we've used the available memory space saved from the comment deletion to improve the performance. We can salvage about one K by giving up the comments. So, I use the 1K to get a more efficient tree search. One improvement I can now do is perform the principal variation that was detected on a previous move. The search of the variation starts out with as strong an alpha-beta number it can find and then prunes the move tree.

Q. Is there a difference in tree searching between the two models- "X" and 2.5?

A. The "X" model uses its tree searching more efficiently than 2.5. The move list is sorted more effectively. Captures are sorted according to material gain. There's a different killer heuristics — which I'd rather not talk about now. There's also some differences in terminal evaluation. One significant difference, for example, is that BORIS 2.5 has always regarded the Bishop and Knight to be of equal value. It loses the minor exchange periodically without any regard to possible consequences. The 2.5 model has a three-point value for both pieces throughout the whole game. The "X" model has a different evaluation.



Keith Bentley, a resident of Silicon Valley who came to the tournament as a guest of John Urwin, was drafted to operate the Tryom unit.

Q. Did you design the Modular Game System?

A. I designed the microprocessor electronics of that system. The mechanical design was an idea of Alan Mead's of Applied Concepts. It was his idea to make a miniature mainframe with replaceable modules that would play many games, not just chess. Our first task was to get Dan and Kathe Spracklen's program on ROM. Dan had SARGON II which he was selling on cassette for the Apple at that time. So we took their SARGON II program an incorporated it into the Modular Game System and came up with BORIS 2.5. I wrote the program for the display and the keyboard. And Dan and I worked together on the handshake between my program and his. And we incorporated both our ideas into the final product.

Q. I know you've previously written programs for police radar. What is the difference between writing a chess program and writing a program for a police-radar system?

A. There's obviously no tree searching involved in a radar program. Police radar is more a signal-processing, digital-filtering application. The resemblance is that you are dealing with a microprocessor in both instances. In police radar you have a real-time system. Chess presents some new concepts in mini-maxing, alpha-beta-pruning and move-ordering. A chess program is always being improved. I think any programmer will tell you as soon as he finishes one program, he'll try to write a better one.

Q. What's the biggest problem you found in writing a chess program?

A. Easily that is in the area of debugging. The game is so rich in development that you may play a large number of games before you get the machine into a certain problem state. Certain things happen in pawn promotion, for instance. You may play many games without encountering even one game involving pawn promotion. So if you finally get a game as far as pawn promotion you may find a machine bug has developed at that point. Then it takes more time to debug adequately than it does to write a change.

Q. Does competing in a tournament offer any problems different than playing a friendly game of chess?

A. Designing an algorithm for a computer chess tournament has a different consideration than designing it to play "family chess". You have to look at time control very importantly. A number of different machines here at the tournament have different time control in their philosopies. Some of them think on

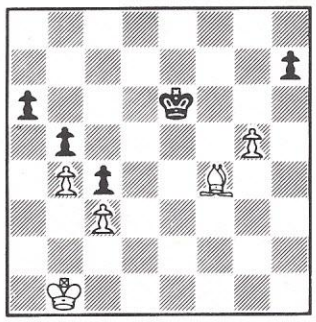
their opponent's time; some of them don't. Some are on constant tme in the computation process and some are concerned with completing a full ply search. There doesn't seem to be a standard philosophy here. You can say that everybody's doing their own thing.

Q. Have you noticed any specific patterns in the other programs?

A. Fidelity, for example, still feels that forward pruning is the best search. Other programs here are running full-width alpha-beta searches. It's obvious that correct technologies and opinions are still emerging. And most of the units here are fighting it out for a place in the market. I think that is very beneficial to ultimate improvements in chess programs. Everyone has an incentive to win. We're working toward real tournament conditions. We're not trying to achieve an academic situation where the computer processes ten million nodes. A human can't do that either, so it's fairly obvious that the microprocessors are fairly limited in regard to their "human capability" even though they're processing at a million cycles per second or greater. The Intel system at this tourna-

Here's How They Played

CCSSIII (White)	BORIS X (Black)
1 e2-e4	d7-d6
2 d2-d4	Ng8-f6
3 Nb1-c3	Nb8-c6(a)
4 Bc1-f4	e7-e5(b)
5 d4xe5	d6xe5
6 Qd1xd8+	Ke8xd8
7 0-0-0+	Bf8-d6
8 Bf4-e3(c)	Bc8-e6
9 Ng1-f3	Nc6-b4(d)
10 Nf3xe5	Nb4xa2+
11 Nc3xa2	Bexa2
12 f2-f3(e)	Ba2-e6
13 Ne5-c4	Be6xc4
14 Bf1xc4	Kd8-e7
15 h2-h4	a7-a6
16 Kc1-b1(f)	b7-b5
17 Bc4-e2	Rh8-d8
18 Be3-g5	Bd6-e5(g)
19 Rd1xd8	Ke7xd8
20 f3-f4	Be5xf4(h)
21 Bg5xf4	Nf6xe4
22 Be2-f3	f7-f5
23 Rh1-e1	Ra8-b8
24 Bf3xe4	f5xe4
25 Re1xe4	Rb8-b6
26 h4-h5	g7-g6
27 h5 x g6	Rb6xg6
28 g2-g4	c7-c5(i)
29 g4-g5	c5-c4
30 b2-b4	Kd8-d7
31 c2-c3	Rg6-e6
32 Re4xe6(j)	Kd7xe6
33 Kb1-b2	Ke6-f5
34 Bf4-e3	Kf5-e4
35 Be3-d4	Ke4-f4
36 Bd4-f6	Kf4-f5
37 Bf6-e7(k)	Kf5-e6
38 Be7-c5	Ke6-f5
39 g5-g6?	h7xg6
40 Bc5-d4	g6-g5
41 Kb2-c2	g5-g4
42 Kc2-d2	g4-g3
43 Kd2-c2	g3-g2
44 Kc2-d2	Kf5-g4
45 Kd2-e2	Kg4-h3
46 Bd4-g1	Kh3-g3
47 Ke2-e3	Kg3-g4
48 Ke3-f2	Kg4-f5
49 Kf2xg2	Kf5-f4



Position after Black's 32nd move

50 Bg1-d4?	Kf4-g4
51 Kg2-h2(l)	Kg4-f3
52 Kh2-h1	Kf3-g3
53 Kh1-g1	Kg3-f3
54 Kg1-f1	Kf3-e4
55 Kf1-g1	Ke4-f3
56 Bd4-e5	Kf3-e4
57 Be5-d6	Ke4-d3
58 Bd6-e5	Kd3-e4
59 Be5-f6	Ke4-e3
60 Bf6-e5	Ke-f3
61 Sealed move	
61 Kg1-h2	Kf3-e4
62 Be5-d4	Ke4-f3
63 Kh2-h3	Kf3-f4
64 Kh3-h4	Kf4-f5
65 Kh4-h3?	Kf5-f4
66 Kh3-h2	Kf4-f3
67 Kh2-g1	Kf3-g3
68 Bd4-e5+	Kg3-f3
69 Kg1-f1	Kf3-e4
70 Be5-d4	Ke4-f3
71 Kf1-e1	Kf3-e4
72 Ke1-d1?	Ke4-f5
73 Kd1-d2	Kf5-e4
74 Kd2-c1	Ke4-f5
75 Kc1-c2	Kf5-e4
76 Kc2-b2	Ke4-f5
77 Kb2-a2	Kf5-e4
78 Ka2-a3	Ke4-d3
79 Ka3-b2	Kd3-d2
80 Kb2-a2	Kd2-e2(m)
81 Ka2-a3	Ke2-d2
82 Bd4-e5	Kd2-d3
83 Ka3-a2	Kd3-c2
84 Ka2-a1	Kc2-d3
85 Ka1-b1	Kd3-e4
86 Be5-d4	Ke4-f5
87 Kb1-a1	Draw

Annotations by George Koltanowski

(a) Strange move. g6 is usually played here in the Pirc Defense.

(b) Rough stuff. Again g6 is best.

(c) White should have considered 8. B-g5 here.

(d) Black should have continued with 9 . . . Ng 4 (threatens Nxe3)

10. Bc5 Ke7
11. Nd5ch Bxd5
12. Bxd6ch cxd6
13. cxd5 Nb8
14. Rd2 Nd7 etc.

Now Black gets into trouble. . . .

(e) Misses the boat!

12. b3 Ke7
13. Nc4 Nxe4
14. Nxd6 cxd6
15. Kb2 Rh-c8
16. Bd3 Nc3
17. Ra1 a5

18. Bd4 wins a piece.

(f) Having played h4 why not follow it up with 16.g4?

(g) This loses a piece. 18 . . . h6; 19. Bxf6ch, Kxf6 and it should have ended the game in a peaceful draw because of Bishops of different color.

(h) If 20 . . . Bd6; 21. e5 or 20 . . . Bq5; 21. Rd1.

(i) 28 . . . Rxg4?; 29. Bxc7ch.

(j) The game was won for White and with the Rooks off the board it should have been easy.

(k) B-Q8 wins with ease. White can bring his king over to Q4 etc.

(l) With 51. Kf2 Kf4

52. Ke2 Ke4

53. Be3 and the White King marches in.

(m) With 80 . . . Kc2 Black forces the draw immediately. There's no way the White King can get back into action. Black plays Kc1, c2 all the time and threatens the QBP (c3) whenever the Bishop wants to hold c1.

ment, for example, is running a nine megahertz system, which is pretty fast. But, you notice it's not playing a very strong game.

Q. What one thing stands out among the programs, here?

A. I would say that there doesn't seem to be any ailment stronger than the one where you want to look at one ply more than you were looking. But the interesting thing is that when you go from ply four to ply five—and if your move list isn't well ordered—then the number of nodes you'll have to look at in ply five is about nine times the number of nodes at ply four. Doubling, tripling or even quadrupling the speed of your processor isn't going to solve that problem. You simply have to use methods other than speed to keep that branching factor on your move list. That is the biggest problem.

At this point John went off to stretch his legs and get a cup of coffee. He gave us the task of monitoring the "X" unit. He was back in three minutes, just in time to enter BORIS' next move himself.

At the tournament, Tryom's "Chess Champion Super System III" had arrived at Le Baron Hotel by United Parcel but there was no one on hand to run the unit. After a quick scurrying about, we finally cornered Keith Bentley. Keith lived close by, and his friend, John Urwin, convinced him to come during the three-day tournament. Bentley agreed to run the Tryom unit.

After unpacking the Tryom unit, we hooked together the different components, then watched Bentley as he learned to run it. After the tournament was over, Keith sent us the following letter describing his experiences:

"I had a great time at the chess tournament operating the Tryom Chess Challenger Super System III. It was enlightening for me since I follow computer chess only half-heartedly. Being at the tournament allowed me to appreciate more fully the problems facing the microcomputer chess programmer as well as the methods used in overcoming these problems. The tournament did a great deal to increase my interest in computer chess.

"The Tryom system did fairly well in the tournament and was easy to use. Overall, the machine was laid out very well. The main unit had an adequate display for use in the stand-alone mode. The push-button switches for entering commands were large and easily accessible. Although the printer unit was not needed for the tournament, I did have a chance to play with it for a few moments and found that it worked with no difficulty. I was surprised that no other games had a printer since it allows users to store positions quite easily. The most impressive part of the Tryom package was, of course, the liquid crystal chessboard display. The display prevented any moves from being entered incorrectly since I could verify the whole board position without any effort.

"operating the Tryom system was simple."

"Operating the Tryom system was simple. Because of the rush to get the first round started on Friday night, I did not have a chance to read the instruction manual. A few instructions from Dave Kittenger, however, allowed me to use the machine properly for the first game. I was more concerned with moving the pieces on the official board and punching the chess clock than I was with running the machine. Later, in entering the position of an adjourned game (against BORIS "X"), a quick look at the instructions booklet allowed me to set up quickly and correctly. Throughout the tournament there was never any problem operating the machine.

"There were only a few problems with the Tryom chess system. The major problem was connecting the printer and the LCD chessboard to the main unit. This took about 15 minutes of concentrated fiddling. The culprit was the connector between the two PC boards. It was possible to slide the two units together only to find out there was no electrical connection between them. This was such a headache in setting up for the first game that the system was left assembled for the remainder of the tournament. The problem could be remedied by using a type of PC connector that provide some guidance for the pins. At the end of a game, I would like to have been able to print out the entire sequence of moves, but I saw nothing in the instructions that showed how to accomplish this. This seems to limit the printer to keeping only a running record of the game and not allowing a summary.

"Compared to other computer chess units, this system doesn't seem to be too bad since it did get two and a half points. The fact that each move took the same amount of time kept the unit from getting into any kind of time trouble. This plagued Sfinks in at least two games. Time considerations may also have cost BORIS "X" a win since it started making moves too quickly. If BORIS "X" had used more of its time to search deeper it might have won. The final result, though, was still two and a half points for Tryom. Other judgments will have to wait for another tournament.

"The human view of the program is a little different. Tryom's actions against the Chess Challenger would be inexcusable in all but the most inexperienced players. Something must be done to Tryom's program to prevent its queen from being chased around while its opponent develops. I was also slightly disappointed that the unit only drew against BORIS "X" when it was ahead in material. Unfortunately, disappointment in the performance of a computer does not spur it on to greater accomplishments. Although a lot of work has gone into the excellent hardware of this machine, it will be up to Tryom to improve the software to keep its game a challenge to the user."

THE CRAY 1 PLAYS CHESS (PART II)

by ROBERT M. HYATT
(University of Southern Mississippi)

Program Performance

This section will attempt to illustrate the level of play that BLITZ exhibits on the CRAY-1 computer.

Figure 1 is from a book on chess endgames. At the 10th ACM tournament, the CHESS 4.9 programming team astounded everyone there by claiming to solve this position with a 26 ply search that took

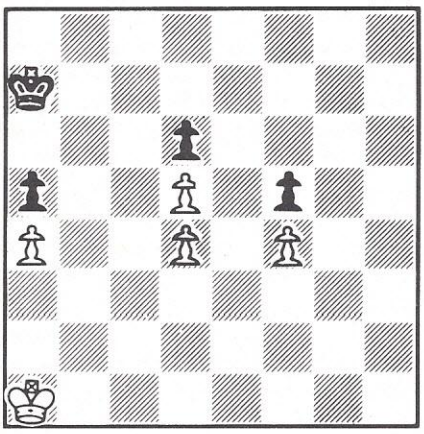


Figure 1

"only" 23 minutes of CPU time. Most of the participants took this as a pre-tournament "psych" job, but later discovered that the claim was valid. This was the first time that a computer chess program had ever gone that deep in a reasonable amount of time; in fact, Monroe Newborn of Mc Gill University estimated that his endgame program would need over 25,000 hours of CPU time to accomplish this task. As you can guess, CRAY BLITZ was given this position and promptly solved it with an 18 ply search in 1 second! Not being content to stop there, however, CRAY BLITZ continued searching since it had a time limit of 5 minutes of CPU time and actually completed a 33 ply search in this time! This was absolutely unexpected. This deep searching was not a fluke either. For the remainder of the game, CRAY BLITZ continued to search 25 to30 plies on each move. The conclusion is that BLITZ is extremely efficient in endgame searching, and seems capable of what might be termed "impossible" searches.

The solutions 1. K-N1, K-N3 2. K-B2, K-B2 3. K-Q3, K-N2 4. K-K3, K-B2 5. K-B3, K-N2 6. K-N3, K-B2, 7. K-R4, K-B1, 8. K-R5, K-B2 9. K-N6, K-Q2 10. KXP and wins.

Figure 2 is from a doctoral dissertation by Hans Berliner of Carnegie-Mellon University, in which he states (after developing a highly selective tactics analyzer) that "because of the depth of this combination, we feel quite safe in saying that no program in the world today can duplicate this performance in any standard time frame." Being unable to resist this challenge, the position was submitted to CRAY BLITZ which promptly found the correct move after using 98 seconds of CPU time to conduct a 6 ply search. The solution is as follows:

1. NXP! with the following possibilities
1 ....., PXN 2. QXKP+, K-B1 3. Q-Q6+, any 4. QXR or K-R1 3. Q-K7!, N-B1 4. QXR or Q-N1 4. RXP+! QXR 5. QXR+, K-B1 6. Q-Q6+, any 7. QXR

As can be seen, CRAY BLITZ can be awesome with a 6 ply search!

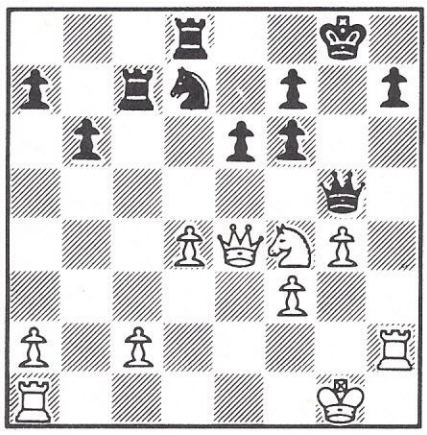


Figure 2

Figure 3 is intended to show one of the particularly sophisticated algorithms in BLITZ, that of evaluating pawn endgames. CHESS 4.9, BELLE, and any other currently active program can solve this position only after a great deal of searching. For example, CHESS 4.9 requires a 9 ply search to make the correct move for the wrong reason. BLITZ has an algorithm that evaluates pawn endings and can play the correct move, P-R4, after only executing a 1 ply search. The major benefit of solving this through evaluation rather than searching is as follows:

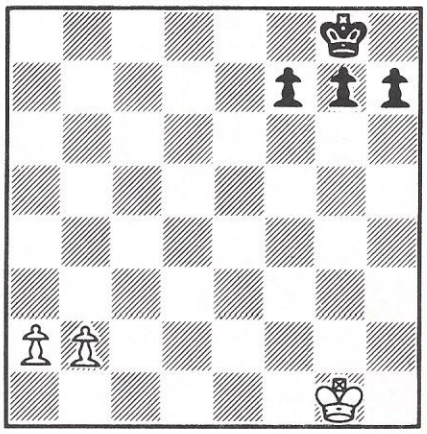


Figure 3

if CHESS 4.9 encounters this position anywhere in a search, an additional 9 ply search is required to determine that the position is won. BLITZ, on the other hand, can immediately evaluate this position as won or lost whenever it is encountered, while CHESS 4.9 might not have time to do an additional 9 ply search, and would score the position as lost for white. These algorithms, coupled with the incredible endgame search depths attained on the CRAY-1, make BLITZ the premier endgame player of all the computer chess programs. The solution is 1 P-R4 and the pawn cannot be prevented from reaching the 8th rank and becoming a queen.

Figure 4 is from the most discussed computer chess game of recent history, between BELLE and CHESS 4.9 at the 9th ACM tourna-

ment. BELLE (white) has just played PXRP and landed in a forced loss. However, CHESS 4.9 returned the favor and played NXB+ and "clutched defeat from the jaws of victory." CRAY BLITZ correctly plays PXN in the position instead of the poor choice made by BELLE, and plays PXBP in 1 second of CPU time instead of CHESS 4.9's move.

In each of these positions, CRAY BLITZ exhibits clear superiority to its closest rivals. While it is certainly possible to choose positions that favor a particular program's tactical ability, this was not the case here. I simply chose positions where I knew what the other programs would play to determine if CRAY BLITZ could do better. CRAY BLITZ seems to be at least the tactical equal of the other programs and should be better in positional judgment due to its sophisticated evaluation routines.

Conclusions

Some general testing with BLITZ has yielded the following observations:

1. CRAY BLITZ performs searches of 6 to 7 ply deep during complex middle game positions and increases to some unknown limit as the game simplifies. This is roughly equivalent to the searches performed by BELLE and CHESS 4.9 in the middle game and far exceeds them in endgames.
2. With this depth of search, and the complex scoring algorithms currently used, CRAY BLITZ could become the *first computer chess master*.
3. Increased search depths greatly affect the utility of the hash table used to store evaluations for positions previously encountered during a search. The deeper BLITZ searches, the more efficient the search becomes. As a note, the above positions were analyzed using a very small table to minimize the impact of the program on the system. The current table contains 8K entries, but can be increased to 200K entries on a 1/2 million word CRAY-1 and even larger as memory size expands. This would reduce the already amazing times even further.

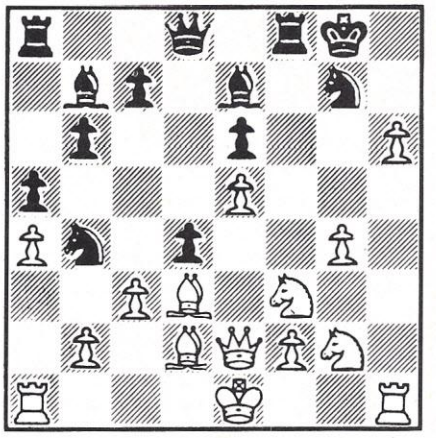


Figure 4

Enchancements

Even though most of the currently implemented algorithms are not suited to vector processing, the unique architecture of the CRAY-1 has many features that can be used as algorithms and recoded in CAL.

The first feature is the completely independent functional units within the CPU. With some clever instruction ordering, more of the functional units could be kept busy giving a higher instruction thruput.

The large number of registers in the CRAY-1 can eliminate virtually all memory referencing, except for instruction fetching. For example, the 64 square board could be kept in T registers, since this data is used extensively in the program. Also, a large number of subscripts are maintained, and could be kept in the B registers ready for quick access, and even in the A registers for the often used ones such as square to, square from, etc.

The large memory size of the CRAY-1 offers another performance boost by allowing an extremely large hash table. This table is used to store the value of each position searched; then, if the same position occurs again by transposing the order of the moves, the score is immediately available if it is still in the table. For example, after N-KB3, B-B4, N-N5, an additional 3 ply search would be done for a nominal search depth of 6 ply. After this sub-search depth is completed, the evaluation of this position is stored in the table. After the following sequence of moves, N-KR3, N-B4, N-N5, the same position as the above one has been reached and the evaluation can be extracted from the table saving the 3 ply sub-search. This also happens for N-KB3, B-B4, N-QB3 and N-QB3, B-B4, N-KB3. As can be seen, there are many duplicate positions that arise and that can be quickly dismissed via the table. Also, the deeper the search, the more often a position is retrieved from the table, the deeper the search can go. The CRAY-1 CPU speed allows some extremely deep searches which cause the hash table utility to rise sharply, yielding the 33 ply searches seen earlier. This table is also used while BLITZ is pondering or computing while waiting for the opponent to move. BLITZ assumes that the opponent will make the move BLITZ believes best and will then start computing on a response, storing each position encountered into the table. When the opponent moves, much evaluation will be saved by retrieving these positions from the table.

In optimizing BLITZ, the flowtrace feature of CFT is very important in isolating those routines that use most of the processing time. This information has already been used to speed up BLITZ by a factor of three (!) by rewriting or eliminating inefficient code. It seems that another quantum leap will occur when the latest version is brought up on the CRAY-1 in the near future.

Even though CFT is clever in producing efficient object code, an additional factor of 2 or 3 can be obtained when the CPU intensive functions are rewritten in CAL.

How to write for Personal Computing

You've written the programs we want to publish. You – the *Personal Computing* readers – are using your computers in businesses, homes, offices and schools. Other readers, just as software-hungry as you, are eager to try out your programs, your applications and your techniques. So why not share what you've done by submitting an article to *PC*?

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Here are some handy guidelines to help you get started.

First, decide what kind of article you want to write. Do you have a *business program* that will help an executive, salesman, doctor, lawyer or shopkeeper function more efficiently? Think about how businesses can benefit from microcomputers – not only in the obvious areas of inventory, accounting and payroll, but in all departments and levels right up to the president's desk. Financial and marketing analysis, time management, planning, material handling, product design and cost-accounting are areas ripe for creative programming.

How do you use your computer for *home and personal applications* in your living room, kitchen, study or den? Again, think beyond the obvious areas of checkbook balancing and budgeting (though these areas are far from exhausted) to other applications. Hobbies, home management, household inventory, gardening and landscaping, personal income and expense analysis, personal mailing lists and word processing are just a few ideas to spark your imagination.

What *education programs* have you written for children, adults, professionals, businessmen and teachers? Computers can not only teach children basic subjects such as spelling, math, geography, economics, civics, grammar, literature and science, but can help adults review or sharpen skills in these areas as well. How else can computers function in or out of the classroom to aid learning? To help teachers and administrators?

Are you proficient in some programming technique or special computer area you could explain in a *tutorial article*? How do you save time, money, computer memory or frustration when programming or using your computer? Others can benefit from the same techniques you use.

Your second step is to write the text of the article. Remember, readers aren't familiar with your program. So explain in detail what the program does and how it does it. Include here the overall structure of your program as well as any special algorithms or routines you've used. Give suggestions for modifying or expanding the program for other applications, other businesses or other situations.

Third, prepare your supporting documentation. Include at least a program listing and one or two sample runs, and add program notes to explain any special commands used or other special features of your program. Use charts, diagrams, figures and photos if they help explain your program and its use.

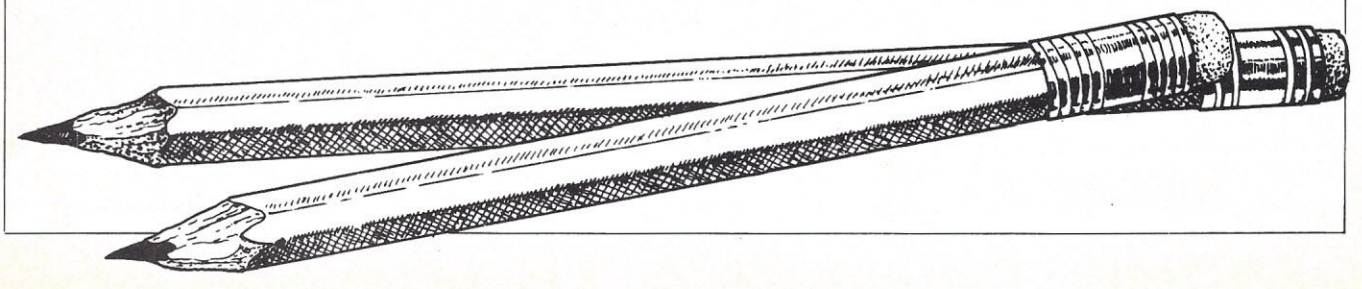
Finally, mail your manuscript. Address it to: Jules Gilder, Editor, Personal Computing Magazine, Hayden Publishing Co., 50 Essex St., Rochelle Park, NJ 07662.

A few suggestions: All submissions should be original, typed (*not* all CAPS), double-spaced and neat. Please include your name and address on the first page of the article and enclose a self-addressed, stamped envelope for return of material.

Since we photograph program listings and sample runs exactly as you send them to us for publication in the magazine, please be sure you use a fresh ribbon for computer printouts. If you don't have a printer, you can type your listings single spaced; but again, be sure you use a new ribbon. (If your program relies heavily on graphics, you can photograph sample runs from your CRT. But take care to avoid distortion due to the curve of the screen.)

Feel free to call us if you have any questions or want to discuss specific ideas. We can give you feedback and suggest appropriate slants and approaches.

We're always looking for fresh, original ideas. While these guidelines will help you in preparing material for *Personal Computing*, don't assume we don't want your idea just because it's not mentioned here. Let us and our readers know what *you're* doing with your computer.



Two Products Tested

BY THOMAS A. THROOP

This month I would like to report on two computer bridge products not previously discussed in this column. The first product is *CompuBridge,* distributed by Barclay Bridge Supplies in Port Chester, New York. The second product is *No-Trump Bridge,* distributed by Instant Software in Peterborough, New Hampshire.

CompuBridge, written for the Apple II computer, consists of a series of programmed lessons on contract bridge. It is programmed to teach a standard American system of bidding oriented to five-card major openings. There are six chapters, as follows: Chapter I — Introduction for the Absolute Beginner/The Mechanics of Bridge Vocabulary; Chapter II — Bridge Scoring/The Point Count System; Chapter III — No-Trump Openings/Strong Two Openings/One of a Suit Openings; Chapter IV — Responses and Rebids; Chapter V — Forcing and Non-Forcing Sequences/Jump Shifts/Slam Bidding/Overcalls/Take-out Doubles; Chapter VI — Defensive Play/Competitive Bidding.

In addition to the six programs for the above chapters, there are two other programs. The first is a "Quizmaker" program, and the second is a "Play of the Cards" program. The Quizmaker deals random hands for problems on point count, opening bids, and responses and rebids. You are asked for your answer to each problem. If your answer is not correct according to *CompuBridge,* you may try alternative answers for as long as you wish, or you may ask for the *CompuBridge*-proposed answer. The Play of the Cards program addresses four subject areas in the play of the hand. These are: High card tricks; Tricks by finessing; Tricks by double finessing; Long suit tricks.

With some of the bidding subjects, as mentioned before, you may ask the Quizmaker program to generate random calls for you to further your knowledge of the current bidding subject. You are given as many chances as you need in order to come up with *CompuBridge's* choice of bid for each randomly generated hand. Whenever you desire, you may ask the program to "tell" you its choice of bid.

The generation of random hands by the Quizmaker program for further exploration of bidding subjects is a very attractive feature. It means that you can compare your bidding ideas with those of *CompuBridge* on a large number of hands. Let's see this feature in action for a couple of the chapters.

Chapter 3 deals with opening bids. After the standard instructional material was presented, I asked the Quizmaker program to generate some random hands. The first four hands generated were as follows:

a.) ♠ 985
♥ 5
♦ KQJ7542
♣ Q5

b.) ♠ J763
♥ Q42
♦ T8
♣ 8742

c.) ♠ AKQ2
♥ AJ876
♦ A3
♣ K

d.) ♠ T4
♥ KT93
♦ 96
♣ AJT63

Notice that each card appears only once in the set of four hands. In other words, a deal of 52 cards is generated for each set of four problems, with each hand in turn being shown for an opening bid. The recommended bids are a.) Pass, b.) Pass, c.) 1 heart, and d.) Pass, which are all reasonable, although with hand (a) you might easily elect a pre-emptive opening bid of 3 diamonds.

Chapter 4 deals with responses and rebids. I explored the Quizmaker's performance on responses. For each random hand, you are asked (as five separate problems) what you would bid over an opening bid by partner of 1 club, 1 diamond, 1 heart, 1 spade, and 1 no-trump. For instance, consider this hand:

♠ KJ86
♥ K5
♦ KJ54
♣ 542

CompuBridge recommended a 1 spade response to 1 club, 1 diamond, and 1 heart, a 3 spade response to 1 spade, and a Stayman response of 2 clubs to 1 no-trump, all of which are correct.

Here is another hand:

♠ -
♥ Q97432
♦ AK9
♣ AJ42

CompuBridge suggested the following responses:

Partner's Bid	*Your Response*
1C	1H
1D	1H
1H	3H
1S	2H
1 no-trump	4C

CompuBridge's responses to each suit opening bid are fine and require no special comment. The

response of 4 clubs to 1 no-trump is the Gerber Convention, (asking the opener for his number of aces and kings) as you are interested in playing 6 or 7 hearts.

CompuBridge performed quite well on most of the random hands. However, a few of the hands dealt gave it considerable trouble. For instance, suppose you hold:

♠ K
♥ KT
♦ T987
♣ AK7654

The suggested responses were:

Partner's Bid
1C
1D
1H
1S
1 no-trump

Your Response
1D
2D
2C
2C
4C

The responses to 1 club and 1 diamond are mysterious. 3 clubs and 2 clubs, respectively, would be much better. A 2 club response to 1 heart or 1 spade is fine. The 4 club response to 1 no-trump is again the Gerber Convention.

Another hand which gave *CompuBridge* some unexpected trouble was this one:

♠ A8763
♥ -
♦ 8765
♣ J963

Here are the suggested responses:

Partner's Bid
1C
1D
1H
1S
1 no-trump

Your Response
1S
1S
Pass
2S
2C

CompuBridge properly suggested a 1 spade response to partner's 1 club or 1 diamond opening bid. However, over partner's opening 1 heart bid, *CompuBridge* recommended a "Pass," whereas a 1 spade response is just as proper as over 1 club or 1 diamond. The 2 spade raise to 1 spade is fine, as is the Stayman bid of 2 clubs over 1 no-trump.

Here is another hand which gave *CompuBridge* trouble, as you will see:

♠ AQ98
♥ K983
♦ K732
♣ Q

The suggested responses were:

Partner's Bid
1C
1D
1H
1S
1 no-trump

Your Response
1H
1H
3H
3S
4C

The 1 heart response to 1 club or 1 diamond, bidding the lower-ranking four card major, is good. The double raises to 3 hearts and 3 spades are correct. The trouble occurs over an opening bid of 1 no-trump by partner. The 4 club Gerber bid is premature. Before asking your partner for aces and kings, you should first seek the most appropriate suit in which to play the final contract. The proper bid is the Stayman bid of 2 clubs to see if your partner has a four card major. As I noted in the previous hand, *CompuBridge* teaches the Stayman Convention, but it failed to use the convention on this and similar hands.

All in all, I believe that *CompuBridge* is quite a worthwhile product for the average home bridge player who wishes to sharpen up his or her bidding. At the time of writing of this article, I called the few problems I observed to the attention of the *CompuBridge* authors, and it is quite likely that these will be corrected by the time you read this column.

The second product to be discussed in this column, *No-Trump Bridge*, is written for the TRS-80, Model 1, Level II computer. This is a product for the playing of no-trump contracts. The computer program generates random deals, discarding the ones it considers unsuitable for you to play at a no-trump contract. For each deal it considers suitable for no-trump play, the program decides on a contract and asks if you wish to play the deal. On the deals you elect to play, you are South (the declarer) at the computer-determined contract. You play the North and South cards, while the computer program defends with the East and West cards.

Let's examine the computer's defense on a couple of deals. Here is the first deal it accepted when I ran the program the first time. Your cards and those of the dummy are as follows:

NORTH
(Dummy)

♠ AK7
♥ T42
♦ QJT63
♣ 42

SOUTH
(Declarer)

♠ J954
♥ QJ975
♦ A5
♣ AT

The computer program suggested a contract of 2 no-trump. Looking at the N-S cards, a contract of 2 or 3 hearts is a much better contract, but the program retained this deal for play in no-trump.

As West, the computer opened the queen of clubs against the 2 no-trump contract. I played small from dummy, East played the 3, and I played the ten from my hand. West continued with the jack of clubs, on which East played the 6, and I won with my ace.

The chances of making this hand did not appear very bright. I entered dummy with the king of spades and led the queen of diamonds from dummy. East played the deuce (a good play as it will be seen) and I played the ace. I could not afford to have West win with the King, and then, after the cashing of club tricks by the defense, have the defense play spades while the diamond suit

was blocked. I then played the 5 of diamonds from my hand, West followed, I played the ten from dummy, and East won with the king.

At trick 6, East played the 9 of clubs, on which West played the 8, while I discarded a small heart from each hand. East continued with the 5 of clubs, which West won with the king, while I again discarded a small heart from each hand. It was a surprise to see West show up with the king of clubs. This meant that the computer program had made the unusual opening lead of the queen of clubs from a suit of four or five clubs headed by the king-queen-jack.

West now cashed the 7 of clubs, I discarded the ten of hearts from the dummy, East discarded the 6 of spades, and I discarded the 5 of spades from the South hand. At this point, the defense erred. West led the ten of spades, instead of cashing the ace of hearts to set the contract. I didn't think the computer program would have unguarded the queen of spades in the East hand, which meant that my only chance to make the 2 no-trump contract was to play low from the dummy, hoping that West had led away from the queen of spades. This was the case; on the 7 from dummy, East played the 3 and I won the trick with the jack of spades.

I won the last four tricks with dummy's ace of spades and three good diamonds, thus making the 2 no-trump contract. As you can see from the complete deal shown below, I should have lost four club tricks, one diamond trick, and two heart tricks, for down two tricks. However, the defense never found their two heart tricks.

Here is the complete deal:

NORTH
(Dummy)

♠ AK7
♥ T42
♦ QJT63
♣ 42

COMPUTER
WEST

♠ QT8
♥ A8
♦ 874
♣ KQJ87

COMPUTER
EAST

♠ 632
♥ K63
♦ K92
♣ 9653

SOUTH
(Declarer)

♠ J954
♥ QJ975
♦ A5
♣ AT

Here is the next deal accepted for play at a no-trump contract. Your cards and those of dummy are as follows:

NORTH
(Dummy)

♠ AJT9
♥ AT7
♦ KT8
♣ 876

SOUTH
(Declarer)

♠ Q82
♥ KJ
♦ QJ72
♣ QJ52

The computer program again suggested a contract of 2 no-trump. As West, the computer opened the 5 of hearts, a rather unusual lead as you will see. I played the 7 from North, the computer played the queen from East, and I won with my king.

Next, I led the deuce of diamonds from the South hand, West played the 9, and I won the trick with dummy's king, East following with the 3. Then I led the ten of diamonds from dummy, which West won with the ace. West now continued the heart suit, leading the 9. I played the ten from dummy, East played the 3, and I won with the jack in my hand.

It was now time for the spade finesse. I led the queen of spades, West played the 4, (an unusual choice as you will see) I played the 9 from dummy, and East played the 5. I repeated the spade finesse by leading the deuce from my hand and playing the ten from dummy, upon which East discarded the 4 of diamonds.

At trick 7, I entered my hand with the queen of diamonds to again finesse West's king of spades, after cashing my jack of diamonds. Tricks 9, 10, and 11 were won with dummy's jack of spades on the finesse, the ace of spades, and the ace of hearts.

East won the last two tricks with the ace of clubs and the 6 of hearts. Thus, I made ten tricks for two overtricks. Here is the complete deal:

NORTH
(Dummy)

♠ AJT9
♥ AT7
♦ KT8
♣ 876

COMPUTER
WEST

♠ K7643
♥ 95
♦ A9
♣ KT94

COMPUTER
EAST

♠ 5
♥ Q86432
♦ 6543
♣ A3

SOUTH
(Declarer)

♠ Q82
♥ KJ
♦ QJ72
♣ QJ52

The computer program was clearly "peeking" on West's opening lead of the 5 of hearts. It presumably chose the heart suit because this suit had the greatest combined length in the East and West hands. If it wished to lead a heart, the 9 would be more usual.

One final comment is that unfortunately, at least in the standard consumer product, you cannot regenerate a given deal. It would be informative to know how the program responds to different lines of play by the declarer on the same deal, besides giving the consumer a chance to see the results of different lines of play. □

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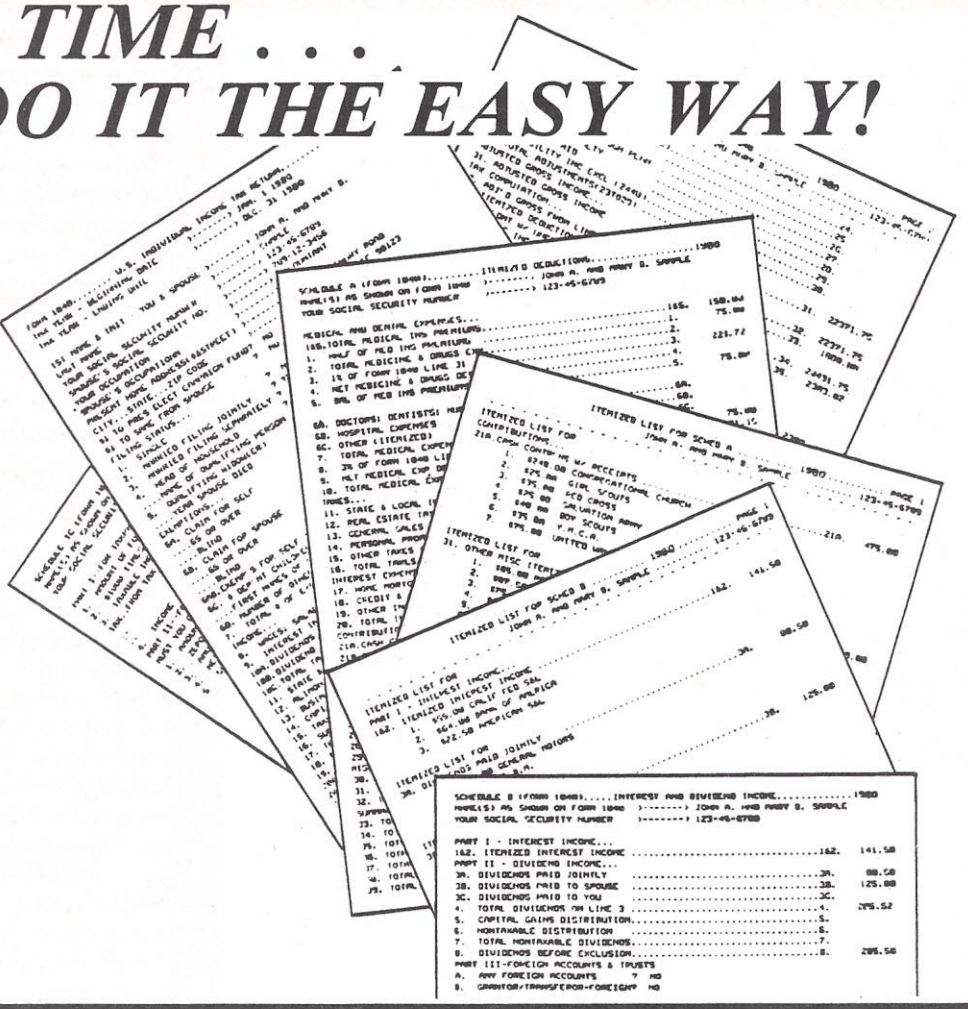

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CIRCLE 21

continued from page 63

Sample Printout

```
                    HOUSE PAYMENTS

 1  YEARS              2  GROSS EARNINGS     3  % INCREASE
      8                   30,000                10
 4  FIRST LOAN $       5  INTEREST           6  TERM
   80,000                   13                   30
 7  SECOND LOAN $      8  INTEREST           9  TERM
      0                     0                    0
10  ANNUAL COSTS       11  AVAIL ASSETS      12  GROWTH RATE
    4,000                50,000                  7
13  TAX BRACKET        14  DOWN PAYMENT      15  % TO HOUSE
      40                 50,000                  25

                CORRECT (Y/##/P/END) ? P


                    HOUSE PAYMENTS  (00)
                    1    2    3    4    5    6    7    8
INTEREST DEDUCT
   FIRST          104  104  103  103  102  102  101  100

CASH PAYMENTS -   646  146  146  146  146  146  146  146
TAX BENEFIT    +   42   42   41   41   41   41   40   40
CASH NEEDED       604  104  105  105  105  105  106  106

GROSS EARNINGS    300  330  363  399  439  483  531  585
AVAIL FOR HOUSE    75   83   91  100  110  121  133  146
ASSETS NEEDED     529   21   14    5   -5  -16  -27  -40
ASSETS LEFT       -29  -51  -67  -75  -73  -60  -36    2
          DO YOU WANT HARDCOPY (Y/N)


                    HOUSE PAYMENTS

 1  YEARS              2  GROSS EARNINGS     3  % INCREASE
      8                   30,000                10
 4  FIRST LOAN $       5  INTEREST           6  TERM
   80,000                   13                   30
 7  SECOND LOAN $      8  INTEREST           9  TERM
   20,000                   11                   10
10  ANNUAL COSTS       11  AVAIL ASSETS      12  GROWTH RATE
    4,000                50,000                  7
13  TAX BRACKET        14  DOWN PAYMENT      15  % TO HOUSE
      40                 30,000                  25

                CORRECT (Y/##/P/END) ? P


                    HOUSE PAYMENTS  (00)
                    1    2    3    4    5    6    7    8
INTEREST DEDUCT
   FIRST          104  104  103  103  102  102  101  100
   SECOND          21   20   19   17   15   13   11    8

CASH PAYMENTS -   479  179  179  179  179  179  179  179
TAX BENEFIT    +   50   50   49   48   47   46   45   43
CASH NEEDED       429  129  130  131  132  133  134  136

GROSS EARNINGS    300  330  363  399  439  483  531  585
AVAIL FOR HOUSE    75   83   91  100  110  121  133  146
ASSETS NEEDED     354   46   39   31   22   12    1  -10
ASSETS LEFT       154  114   80   52   32   21   21   32
          DO YOU WANT HARDCOPY (Y/N)
```

COSTS of owning the house. In the first year, the down payment is also considered a cash payment.

Watching George as he dips into his pocket, we can see his problem. In the first year, he has to pay the down payment and the mortgage payments along with the annual costs. Thus, his cash payment is $64,600 in that year. Before clutching his heart and falling over, George realizes that the IRS has agreed to pay $4,200 of this. That leaves George in need of only $60,400!

Well, let's see where George is going to come up with that money. First, his GROSS EARNINGS are $30,000 in the first year. He can pay $7,500 from earnings. This means that he only needs $52,900 from his asset pool. George will need to borrow $2,900 to cover this. Thus, he will be further in debt at the end of the first year than he was before it began. In fact, George will not have any available cash for the first eight years.

This may not be a very comfortable situation. It is generally not too wise to plan finances that closely. What if George gets laid off or gets sick?

To let George keep more money on hand for "rainy days," consider having him borrow $20,000 from the seller of the house. This reduces his DOWN PAYMENT to $30,000 (see Figure 3). Looking at Figure 4, the results appear more tolerable. George always has some money on hand.

What if George would pay more than 25% of his gross income for housing costs? What if his salary grows at less than 10% per year? What effect would an increase in annual costs have? These are the kinds of questions that the program can answer quickly for you. It is very useful to be able to "what-if" a situation to examine the costs of various courses of action and determine your best course.

Remember that this projection, as is true of all projections, is only a rough guess at the future. Obviously, it is impossible to predict eight years out into the future with any great degree of accuracy. But you can gain some very useful insights into how to structure a real estate deal by thinking about the impact of different approaches. □

SOFTWARE

Word Processing, Financial Planning Software from Vector Graphic

Word processing and financial planning software for its family of integrated information systems is offered by Vector Graphic, Inc.

The two software packages coupled to the company's lowest cost system, the VIP, provide, at $4145, the most versatile and lowest cost business information system that's available off-the-shelf, according to the company.

Addition of a high speed daisy wheel printer increases the price to just over $7000, still substantially lower than many systems with far less capability, the company said.

The new word processing software has been designated Memorite III; the financial planning system is called Execuplan. Both operate on the VIP (Vector Intelligent Partner) microcomputer under Digital Research's CP/M 2 operating system.

Memorite III offers more than a dozen new features that include a built-in quick reference manual that displays answers on command; fast editing due to a memory capacity of 17 pages without disk access; and field-accessible software so that user-defined features can be added as needed.

Combined arithmetic and memory provisions permit "what if" calculations to be made instantaneously, with you simply entering any projected change. Execuplan automatically computes the effects of a change on all given elements of a financial plan — cost, profit, taxes, etc. — and displays the answers.

Both the word processing and the financial planning software respond to straightforward commands and no formal programming knowledge is required, the company said.

The two software systems can be readily integrated. Combined numeric and non-numeric information can then be printed out as it might be in a monthly financial report interspersed with narrative passages, or in any other document involving numbers and words.

The new Memorite III word processing software is priced at $450; the Execuplan package costs $150. For more information contact Vector Graphic, Inc., 31364 Via Colinas, Westlake Village, CA 91362; (213) 991-2302.

CIRCLE NO. 182

Three Accounting Packages

Graham-Dorian Software Systems introduces Order Entry/Invoicing, Inventory II and Payroll II — three computer software packages that can stand alone or be interactive with the company's other accounting packages. Each trans-

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*TRS-80 is a Tandy Corporation trademark. Use of above operating systems may require the use of Radio Shack TRS-DOS. Radio Shack equipment subject to the will and whim of Radio Shack.

ORDERING INFORMATION

We accept Visa and Mastercharge. We will ship C.O.D. certified check or money orders only. Massachusetts residents add 5 percent sales tax.

The company cannot be liable for pictorial or typographical inaccuracies.

CIRCLE 25

TRS-80
BASIC PLUS
ZBASIC, SIMUTEK'S BASIC COMPILER

The following **BASIC PROGRAM,** written on the TRS-80, was compiled using MICROSOFT'S BASIC COMPILER and SIMUTEK'S BASIC COMPILER. *We feel the results speak for themselves!*

```
10 '  SPEED TEST
    SIMUTEK ZBASIC COMPILER VS. MICROSOFT COMPILER
15 CLS:PRINT@0,"HIT A KEY WHEN READY TO START TEST";
20 I$=INKEY$:IFI$=""THEN20ELSEFORZ=1TO10:
FORX=15360TO16383:POKEX,191:PRINTPEEK(X);:NEXTX
30 FORX=0TO127:FORY=0TO47:SET(X,Y):NEXTY,X
:FORX=127TO0STEP-1:FORY=47TO0STEP-1:RESET(X,Y)
:NEXTY,X:FORX=1TO1000:GOSUB1000:NEXTX,Z
40 CLS:PRINT"FINISHED WITH PROGRAM TEST";:STOP
1000 RETURN
```

BASIC PROGRAM SIZE: 329 BYTES
PROGRAM RUN: 22 Minutes, 37 Seconds

Compilers:	Microsoft	Simutek
Compiled Size:	10057 Bytes	1228 Bytes
Compile Time:	14 Minutes	0.75 Seconds
Program Run:	17 Min. 04 Sec.	1 Min. 46 Sec.
System Req:	48K 1 Disk	16K LV II or 32-48K Disk
Price:	$195.00	Tape $99.00, Disk $129.00

ZBASIC is an "Interactive Compiler". This means it is resident while you write your basic programs. You may compile your program and run it or save it, without destroying your resident basic program! In fact, jumping back and forth between your compiled program and your basic program is one of it's best features!

Simutek's compiler allows saving your "compiled" programs to tape or disk. Programs may then be loaded by use of the system command for tape, or as a /CMD file from DOS. This makes it extremely hard for people to "pirate" your programs.

Best of all, Simutek does not charge royalties on programs you sell that are compiled with ZBASIC! (Microsoft charges 10% or $200 a year!)

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Some of the basic commands supported by ZBASIC:

FOR	NEXT	STEP	IF	THEN	ELSE	PEEK	ON GOTO
SET	RESET	POINT	CHR$	RANDOM	RND ( )	POKE	ON GOSUB
DATA	READ	RESTORE	END	GOTO	GOSUB	CLS	
INPUT	INKEY$	LET	STOP	OUT	INP	RETURN	
PRINT	LPRINT	PRINT@	USR	SGN	INT	ABS	
SQR	LEN	ASC	VAL				

INT. MATH: +, −, *, /, AND, OR, SQR

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CIRCLE 26

action entry is carried to every part of the system of packages whenever feasible.

All programs are written in CBASIC—2, run on most CP/M (by Digital Research) systems and come with source code. The packages are also available on various mini-floppy formats, and can be used on various hard disk systems.

Order Entry/Invoicing, designed for manufacturers or wholesalers/distributors, fits some retail applications. The program runs interactively with Graham-Dorian's Inventory II package, and will automatically post to the accounts receivable, if used, and prepare data to be entered into the general ledger.

The program enters the order, processes it, places items on reserve from inventory, then invoices the customer; it updates general ledger and posts to accounts receivable. Among other capabilities, the system can specify a shipping date, check to see if the order was shipped as originally entered, and then allow for last-minute changes before shipping. It allows for non-inventory or miscellaneous items; flaging an order to show it already has been sent, and printing duplicate invoices. The picking list will include information on item location, and can be used as a packing slip. One 8″ single-density disk accommodates data storage for 200 orders and 1000 line entries.

Inventory II, a complete inventory control system primarily for wholesalers, distributors and manufacturers, stands alone or, when interfacing with sales order entry/invoicing package, ties into accounts receivable and general ledger. For manufacturing systems, Graham-Dorian's bill of materials (parts explosion) package should be added as an option to Inventory II.

The program compiles reorder, on order, stock out, and sales reports, and calculates quantity pricing and profit analysis by item. One 8″ single-density disk accommodates data storage for 400 to 500 inventory items.

Payroll II interacts with general ledger and posts to job costing. It prepares paychecks, year-to-date reports, employee list, check register report, deduction register, look-up or change or removal of inactive employees.

The accounting packages are priced at $1000 each. For more information contact Graham-Dorian Software Systems, Inc., 211 N. Broadway, Wichita, KS 67202; (316) 265-8633. CIRCLE NO. 183

Introduction to Basic Programming, Part I

Radio Shack's "Introduction to BASIC Programming, Part I", is part of a complete classroom package designed to provide students with a first experience in computer programming and requires little programming or computer knowledge on the part of the instructor.

The package includes a teacher's manual, a set of transparencies for use with an overhead projector and 25 student workbooks (additional workbooks are available separately).

The package is designed to assist students in identifying important concepts, principles and techniques related to computer programming and to provide them with a means of checking their knowledge of this information. It also gives

students practice in applying their knowledge and skills in developing computer programs written in BASIC, the company said.

Each lesson consists of five parts, beginning with an "Overview" which gives a general orientation to the topics to be covered in the lesson. This is followed by the "Objectives" of the lesson, detailing the skills the student will master on completion of the lesson.

A "Note-Taking Guide" keeps the student focused on the important aspects of the lesson as material is presented via the overhead projector transparencies. Each lesson then has a "Quick Quiz" to let the student determine how well the content of the lesson has been learned. Finally, the "Activity" portion of the lesson provides actual "hands-on" application of the concepts and techniques studied in the lesson.

One or more 4K or 16K Level I or Level II TRS-80 Model I microcomputer systems are required to use the Introduction to BASIC, Part I program. Price for the program is $159.95.

For more information contact your local Radio Shack dealer or Tandy Corporation/Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102; (817) 390-3272.

CIRCLE NO. 184

Computerized Job Control System

High Technology, Inc. now brings the advantages of computer-assisted job control to small-to-medium-size manufacturers and contractors. Job Control System offers job costing and reporting which provides management with reliable measures of productivity, the company said.

JCS furnishes instant job status checks for determining departmental efficiency and exact work-in-progress figures. The program combines information on job orders, estimates, labor hours, material costs and service costs to produce several reports. Job listings, job cost summaries, detailed individual job reports, and work-in-progress reports give profit/loss values and variances so that job estimates and work standards can be fine-tuned.

An existing manual method such as one consisting of time cards, material tickets and outside service documents, can be easily integrated into the Job Control System. JCS can be customized so that rate structures, report formats and up to 500 cost centers can be tailored to reflect the requirements of any individual business. By allowing for as many as 400 jobs in progress, JCS can meet the needs of a wide variety of small-to-medium size manufacturers and contractors.

JCS is menu-driven and easy to use. A separate tutorial program is included which trains you by simulating the system's operations. A manual provides step-by-step procedures with numerous illustrations; no programming experience is necessary.

JCS is written in PASCAL and requires a 48K Apple II with three disk drives and a 132-column printer. Suggested retail price is $750.

High Technology, Inc. also offers, on disk, the programs featured in the book, *Practical BASIC Programs*. These BASIC programs are taken from applications in four general categories: business, statistics, mathematics and miscellaneous. Programs deal with subjects as varied as decision analy-

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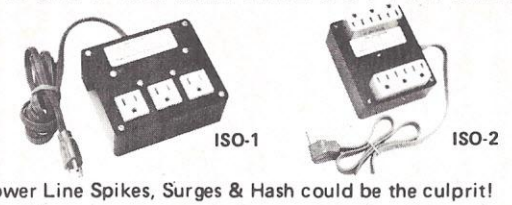

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CIRCLE 31

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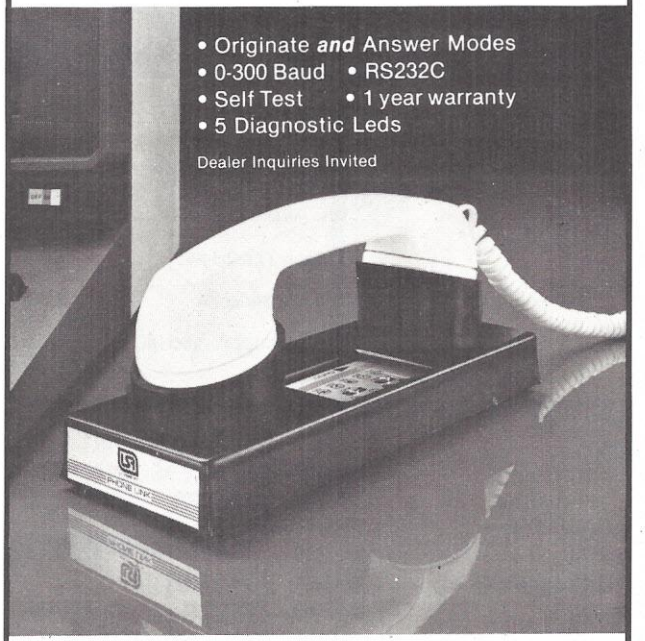

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CIRCLE 29

WHAT'S COMING UP

sis, checkbook reconciliation, statistical techniques, and federal tax form preparation. The book, which is included with the diskette, presents each program with a description, sample run, practical problems and a BASIC source listing. To enhance the use of the programs, a table of contents for each category is accessible through a menu.

The package requires a 32K Apple II and one disk drive. Suggested retail price is $40.

For more information contact High Technology, Inc., 8001 N. Classen Blvd., P.O. Box 14665, Oklahoma City, OK 73113; (405) 840-9900. CIRCLE NO. 185

Information Management with No Programming

Prism, a new information management system for Digital Research's CP/M integrates the features of a data base management system with those of a program development system. This enables you to develop applications like mail lists, patient records, or real estate listings without programming. More complex applications such as accounts receivable, payroll and inventory control, may be developed with less effort and cost, the firm said.

To accommodate the wide variety of applications possible using microcomputers, Prism is offered in two versions: PRISM/IMS and PRISM/ADS.

PRISM/IMS, Prism's Information Management System, is designed for users with little or no computing knowledge; it requires no programming in order to develop complete, tailored applications. PRISM/IMS's features and capabilities include user-oriented displays and operator prompting, user-definable multi-keyed data structures, flexible report generation, and file browse and query facilities.

PRISM/ADS, Prism's Application Development System, is designed for the more knowledgeable user with some programming experience. PRISM/ADS provides a generalized data management language, user-definable menus, password protection of sensitive functions and files, display formatting and data entry functions, and a complete library of programming aids.

"Systems developers, computer dealers, and OEMs will find PRISM/ADS particularly appropriate for developing specialized business applications for their clients and customers," a spokesman stated.

Prism runs on microcomputers using CP/M and CBASIC-2 with 48K memory or more, two or more diskettes or hard disk, and a CRT with cursor addressing and clear screen features. PRISM/IMS is $495 and PRISM/ADS costs $795. For more information contact Micro Applications Group, 7300 Caldus Ave., Van Nuys, CA 91406; (213) 881-8076.

CIRCLE NO. 186

Electronic Typing

The Zenith Data Systems word processing system is designed for operating simplicity. Any good typist can become productive in a few hours, the company said. The system consists of a Z89 microcomputer with built-in keyboard and video display screen, plus ZDS software that

allows a good typist to learn in hours instead of days.

Labor saving features of the ZDS system include scrolling, formalizing, realignment, centering, justified margins, and character counting. The system's editing function provides full-screen control of cursor, normal and reverse video, and the changing or deleting of characters, lines or paragraphs. The computer organizes up to 40 documents per floppy disk and provides instant access to any disk document.

The Z89 "Electronic Typing" word processing system, since it is microcomputer-based, also offers the utility and flexibility for data processing for financial analysis, budgets and other office functions with available, optional software.

The Z89 keyboard follows standard typewriter layout with 72 keys. It includes 12 special function keys (8 user-programmable) and a 12-key numeric pad for ASCII characters. The video display features 24 lines of 80 characters each, with a 25th line for user information; brightness control; antiglare screen; and reverse video for editing.

The Z89 microcomputer with two Z80 microprocessors has a RAM capacity of 48K bytes, a built-in 5¼" floppy diskette with 100K bytes storage. Optional storage of between 200K and 2 megabytes is available with the Z87 and Z47 disk drives respectively.

Suggested retail price for the system is $2,895 for the hardware and $395 for the software (a letter quality printer is needed, which will retail between $2,200 and $3,200). For more information contact Zenith Data Systems Corp., 1000 Milwaukee Ave., Glenview, IL 60025; (215) 351-0498.

CIRCLE NO. 187

Small Business Financial Planning Program

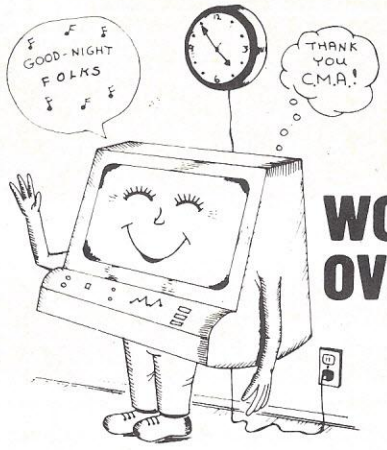
You press a few keys on your personal computer and make a startling discovery: although your business is growing at 20 percent a year, you'll have a $61,000 overdraft at the bank in 1984. Should you reduce inventories? Borrow? Invest? The answer, which might cost thousands of dollars on a large computer or from an accounting firm, can be printed out in seconds.

The secret is a computer program, Finplan, released by Hayden Book Company, Inc. Finplan is the first serious microcomputer-based financial planning and forecasting tool for small businesses, according to Hayden. Using an unlimited variety of "what-if" assumptions, the program can create projections of earnings statements, balance sheets, and analytical ratios; and calculate return on investment, depreciation, and corporate taxes.

Finplan helps the small business owner make complex decisions, such as whether to add a product line or when to incorporate; and tests the effect of inflation and other factors on the success of a company, the company added.

Finplan runs on a Radio Shack TRS-80 Level II, 16K, single-disk system. The package comes with a 76-page user guide written around a hypothetical small business case history, making it easy to follow. Finplan is priced at $69.95 on tape and $74.95 for the disk version. For more information, contact: Alan Boyd, Hayden Book Company, Inc., 50 Essex Street, Rochelle Park, NJ 07662; (201) 843-0550 Ext. 381.

CIRCLE NO. 188



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CIRCLE 32

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CIRCLE 30

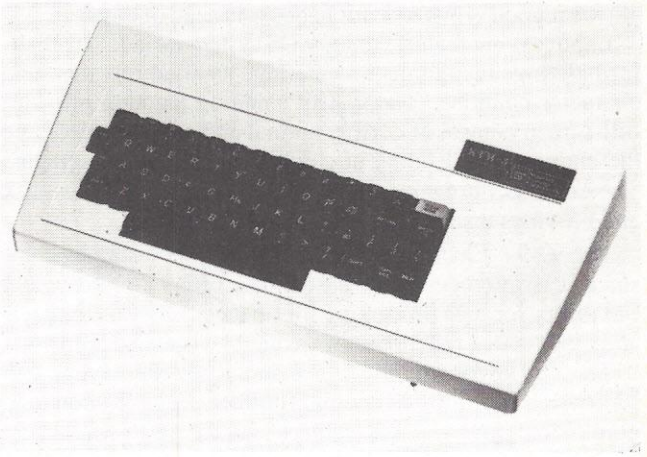
PERIPHERALS

Keyboard Terminal Modules

A line of keyboard terminal modules was announced by Synertek Systems Corporation. The new units, the KTM-3s, provide full ASCII keyboard, composite video for user-supplied CRT monitor, and power supply in a white case.

These units come in two versions — a 40 character display width and an 80 character display width (KTM-3 and KTM-3/80 respectively). They represent the low-cost approach of splitting up the terminal into the keyboard/digital electronics and using a standard CRT monitor, the company said.

The KTM-3s consist of a 58-key keyboard which generates the full 128 ASCII set of upper and lower case alphanumeric characters using an 8×10 field size matrix. Video control is provided for scrolling, full cursor control, and absolute, as well as relative, cursor positioning. Clearing can be achieved to end-of-line or end-of-screen. The KTM-3s provide even, odd or no parity with one or two stop bits. Framing and parity errors are displayed. With its switch-selectable baud rates of 110 to 19.2K and its control and character generator ROMs compatible with EPROMs, the



KTM-3s are easily customized, the company said.

The KTM-3 case is an injection molded, heavy-duty (commercial quality), white plastic unit with heavy plastic snap-on base. The cases of the KTM-3 and KTM-3/80 are designed for accessibility to the switches through convenient openings at the back of the case, the company said. The +5V power supply is built-in for added convenience.

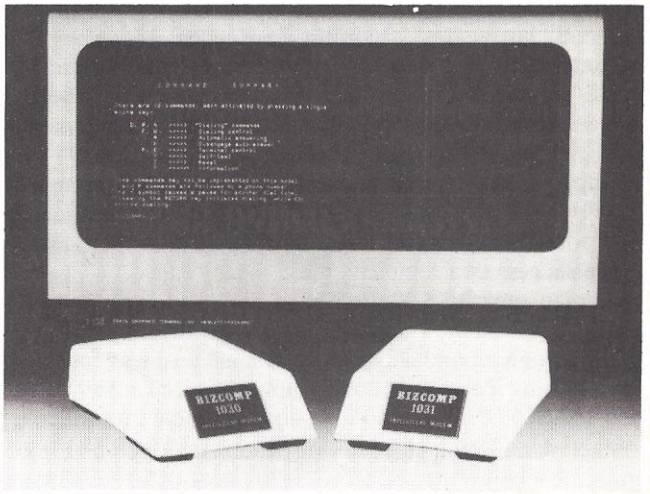
Price for the KTM-3 is $389 and the KTM-3/80 is $449. For more information contact Synertek Systems, 150 South Wolfe Rd., Sunnyvale, CA 94086; (408) 988-5689.

CIRCLE NO. 189

Intelligent Modems

Bizcomp Corporation has introduced Model 1030 and 1031 Intelligent Modems, which offer increased capabilities compared with ordinary modems.

The 1030 Series combines a low error rate modem with an automatic calling unit (ACU) and custom BIZ-080 microcomputer into a compact FCC-registered unit with auto-answer, auto-dial and auto-repeat dial features. According to the company, the key to this enhanced performance is Bizcomp's unique Code-Multiplexed Design which allows Intelligent Modem control using the same terminal as data communication.



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CIRCLE 36

For computer sites, code-multiplexing also enables communications software to be written in high level languages such as BASIC or COBOL, speeding development time. Applications include computer/terminal networking, financial transaction entry, store-and-forward message routing, remote database access and remote computer diagnostics. Interfacing to RS232-equipped computers, terminals and word processors requires only a 3-wire data cable.

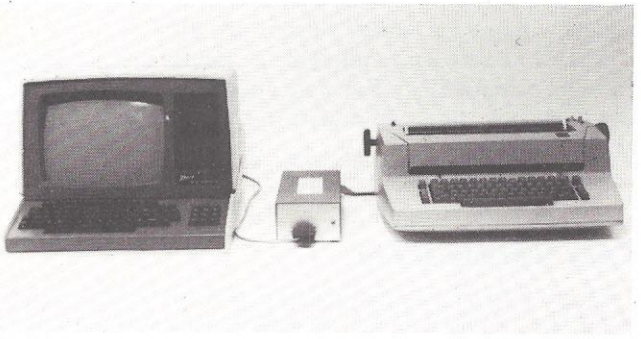
Model 1030 has auto-dial, auto-answer and automatic repeat dial using dial pulse signaling. The top-of-the-line 1031 adds command-selectable dial pulse or tone dialing, and self-test for ensuring full functionality. The tone dialing capability of the 1031 makes it ideally suited as a CPT-TWX network interface, the company said. Both models feature automatic baud rate acquisition and communication rates of 110, 134.5, 150, 200 or 300 baud.

Prices are — Model 1030, $395; Model 1031, $495. For more information contact Inquiries Manager, Bizcomp Corporation, P.O. Box 7498, Menlo Park, CA 94025; (415) 966-1545. CIRCLE NO. 190

Selectric Conversion System

Escon Products, Inc. announces the introduction of its EP-104 Selectric Conversion System which offers letter quality printing at an affordable price. The system allows connection of any micro to any Selectric I, II or III.

Providing the quality and reliability of the Selectric typewriter, the system gives the versatility of total computer control. Designed for both business and personal use, the unit has applications in word processing, accounting and programming. Manual operation of the typewriter is not affected, the company said.



A single-board computer is the heart of the new system, giving precise control of all typewriter functions and timing, the company said. Internal firmware features include form-feed, buffer hold, bell output, backspace and tab control.

Parallel and RS-232C versions are standard, and an adapter to IEEE-488 computer output is also available. A 96-character buffer is used for incoming character storage, with various handshaking protocols accommodated. RS-232 baud rates are switch selectable from 110 to 9600 baud.

Prices range from $575 to $675. For further information, contact Escon Products, Inc., 12919 Alcosta Blvd., San Ramon, CA 94583; (415) 820-1256. CIRCLE NO. 191

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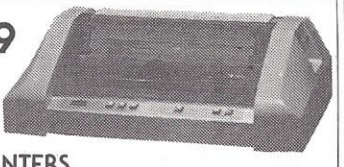

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CIRCLE 33

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CIRCLE 37

WHAT'S COMING UP

Smart Terminal Features Super-Sharp Resolution

Zenith Data Systems offers the Z19, an enhanced version of the company's video display terminal for the small computer market. The Z19 "smart" data terminal features a premium deflection system which creates a smaller spot size for super-sharp resolution, the company said. The terminal's 12-inch diagonal screen contains a format of 24 lines by 80 characters, plus a 25th user-status line.

Video features permit complete screen control, making the Z19 particularly useful for data entry and word processing. The keyboard follows the standard typewriter format, with enlarged high-use keys and a separate numeric keypad. Direct cursor control lets you move anywhere on the screen for corrections and editing.

Interfacing of the Z19 is by standard Electronic Industries Association RS-232 at speeds of 110 to 9600 baud. Compatibility with Digital Electronic's popular DEC-VT52 Terminal can be configured from the keyboard, an outside computer or a special interior switch.

Zenith offers a 90-day parts and labor warranty, and a service network to provide on-site service. Some service outlets will provide loaners when necessary.

The Z19 smart data terminal has a manufacturer's suggested retail price of $995. For more information contact Zenith Data Systems, 1000 Milwaukee Ave., Glenview, IL 60025; (312) 391-8860.

CIRCLE NO. 192

Color Graphics Board

Heath Company introduced its new HA-8-3 Color Graphics Board — designed for use with Heath's H-8 and All-In-One Computers. Heath's Color Graphics Board uses the advanced TI-9918 Color Video Display Generator from Texas Instruments. To produce nearly any sound desired for games and other applications an AY-3-8910 Programmable Sound Generator is also included.

Eight channels of analog-to-digital conversion can handle up to four X-Y joystick consoles (not included). Each console has 4 bits of parallel input/output (I/O) for switches or LEDs. A socket is also provided for the AMD-9511 Arithmetic Processor Chip (not included), which permits extremely rapid floating point, trigonometric and transcendental computations. The chip can also perform hardware multiplication/

division of both integer and floating point numbers, the company said.

The HA-8-3 board connects to the video input of most video monitors as well as other video accessories utilizing NTSC composite color video. Heath provides demonstration software for its color graphics board on a 5.25″ floppy disk, at no additional cost.

Price is $395. For complete information contact Heath Company, Dept. 350-590, Benton Harbor, MI 49022.

CIRCLE NO. 193

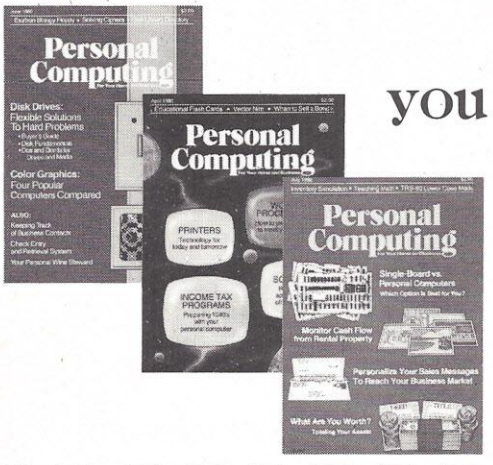
Texas Instruments Announces New Prices

Texas Instruments Inc. has combined new software support from within TI and from third-party developers with a $300 reduction in the suggested retail price for the TI-99/4 Home Computer to support the growing interest in computer applications in the home.

The new suggested price for the TI-99/4 is $649.95. Complementing this reduction is the new suggested retail price for the RF Modulator, reduced from $75 to $50. The RF Modulator allows the TI-99/4 to be connected to any color or black and white television set.

To promote the development of additional software for the TI Home Computer, two new software languages are being made available to third-party authors, TI Extended BASIC and USCD Pascal. TI Extended BASIC and the Memory Expansion Unit (that adds 32K bytes of random-access memory to the 16K bytes resident in the computer) offer software authors the opportunity to write a full range of software for the TI-99/4. The enhanced language offers a number of features, including the ability to move up to 28 objects around the screen independently, each with its own speed and direction. In addition, information can be displayed at or accepted from any location on the screen — a feature useful for displaying forms or tabular information without the scrolling effect of standard programming.

For more serious programmers, TI is offering third-party software authors a new low-cost development system for compiling software using UCSD Pascal, Version IV.O. The new low-cost development system offered by TI includes a modified TI-99/4 computer console and a Solid State Software command module designed for debugging assembly-language programs. In addition, the development system includes two disk drives, a disk controller, a modified RS-232 Interface and a prototype UCSD p-System software development peripheral. Price for a complete system is $5000. For more information contact Texas Instruments Inc., Consumer Relations, P.O. Box 53, Lubbock, TX 79408; (214) 995-4028. CIRCLE NO. 194



If you're missing any of these you have gaps in your data bank.

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SYSTEMS

Colt Desktop System

The Durango Colt Desktop Computer System, complete with software programs for standard small business requirements, is now available at Computer Store retail outlets.

The processor, keyboard, display screen printer and diskette drive are designed into a unit a little larger than an office typewriter. This allows complete portability when the Colt must serve several departments or perform functions at different locations, the company said.

The Colt system is supported by an operating system, system support utilities and a STARBASIC compiler/interpreter. A proven set of pre-programmed applications (Small Business Applications) are available with the system including: general ledger, accounts receivable, accounts payable, invoicing with inventory control and sales analysis.

A word processing software package called Startext is also available. In addition to performing basic word processing functions, this program is capable of interfacing to data processing files. A professional time reporting system, designed for the small-to-medium size company which needs to track personal time and expenses as well as other costs on a

client or project basis for analysis and billing purposes, is also available.

The basic Colt unit (video screen, printer, keyboard, processor and file memory in its single, operator-oriented workstation) is priced at just under $10,000. For more information contact the Computer Store, Inc., 50 Mall Rd., Suite G-2, Burlington, MA 01803; (617) 272-0294. CIRCLE NO. 195

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- **Northeast:** Arlene Schulman Personal Computing Magazine, 2 Park Ave., New York, NY 10016; (212) 340-9780.
- **Southern California:** Michael Reynolds, Hayden Publishing, 8939 S. Sepulveda Blvd., Los Angeles, CA 90004; (213) 641-6544.
- **Northern California:** Bill Knickel, 1307 South Mary Ave., Suite 212, Sunnyvale, CA (408) 736-6667
- **Japan:** K. Yanigihara, International Business Corp., 10-10 Shinjuku 3-come, Shinjuku, Tokyo, 160 Japan: (03) 350-0272.

Apple II Plus and Apple II BASIC Manuals

The new printing of *Training Your Computer*, Apple Edition, contains specific instructions and coding for the Apple II Plus as well as for the Apple II computers. Both Applesoft (floating point) and Integer BASIC statements are provided and differences in uses discussed.

Training Your Computer is a hands-on manual which helps beginning computer users learn to put the computer through its paces. In 64 pages it proceeds from simple programs involving PRINT statements to programs involving graphics and high resolution plotting. Each lesson involves one new technique and reviews one or more previously demonstrated techniques. Each page provides a new program or program variation on topics such as spelling, design, arithmetic, finances, temperature, graphics and games. You type the short program into memory, check the structure of the programming statements and discover the result of the technique being utilized.

Distribution is handled by A. R. Davis & Co., P.O. Box 24424, San Jose, CA 95154. *Training Your Computer* is available in Apple, Pet, TRS-80 and Compucolor-Intecolor editions at $3.95 plus tax and $.75 for mailing. For further information contact Metra Instruments, Inc., 2056 Bering Dr., San Jose, CA 95131; (408) 297-8530. CIRCLE NO. 196

Mini-Rack II

The Wilson Jones Mini-Rack II is a printout storage and retrieval system that includes a suspension rack with casters, and four pressboard hanger binders at a suggested retail price of less than $48.

Mini-Rack II holds up to 3600 unburst 14-7/8″ × 11″ printout sheets. It has woodgrain vinyl side panels for good looks and black tubular steel for strength, the company said.

Mini-Rack II moves easily from desk to desk, department to department or can be filed under a desk. You can stack Mini-Rack II to make a data bank or sit it on a desktop, counter or credenza.

With Mini-Rack II, you can remove the hanger binders from the top or with optional T-bar suspension system, you can remove binders from the sides.

For more information contact Wilson Jones Co., 6150 Touhy Ave., Chicago, IL 60648; (312) 774-7700.

CIRCLE NO. 197

Double-Density Double-Sided Flexible Mini Disk

Syncom's Ectype magnetic media products adds the new 5-1/4″ double-sided, double-density Flexible Mini Disk to their product line. Reinforcing rings are constructed on all diskettes to insure 100 percent performance on IBM, Apple, Pet and other computer drive equipment, the company said.

Like its counterpart, the single-sided Ectype 5-1/4″ Flexible Mini Disk, the new Ectype double-sided diskette is designed with a wear life up to 10 million passes on both hard and soft-sector products, Syncom said. The "human-engineered" E-Z Vue box with its Tyvex envelope packaging insures reduced abrasion and elimination static.

Syncom electronically checks each and every disk to insure proper performance. Prices range from $4.50 to $5.80. For more information contact Syncom, Bill Dalman, Marketing Manager, P.O. Box 130, Mitchell, SD 57301; (800) 843-9862. CIRCLE NO. 198

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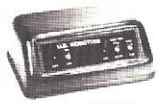

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CIRCLE 39

COMPLEMENTS

Modular Workstations

The Space Station, a new line of modular, all-purpose workstations for data and word processing and other electronic and office equipment, has been introduced by the James Systems Division of James Metal Products Co.

The modern, cantilevered stations can be used singly or joined in various modular configurations, depending on the needs of the user, the company said. The Interface Locking System enables stations to be securely joined to provide extra stability and strength. The Space Station has been tested to hold loads of 400 pounds.

Tops are available in woodgrains of walnut, oak and in putty. Depths are 24 and 30 inches, and lengths range from 30 to 42 inches. The 24″ × 30″ and 24″ × 36″ stations, as well as the triangle connectors for them, can be shipped via UPS.

Suggested retail prices for the Space Station start at $120. Additional information can be obtained from the James Systems Division of James Metal Products Co., 2929 N. Oakley Avenue, Chicago, IL 60618; (312) 472-2611.

CIRCLE NO. 199

Aid to Programming for TRS-80 Pocket Computer

The new *Pocket-BASIC Coding Form*, by ARCsoft Publishers, is an aid to writing programs for the TRS-80 Pocket Computer. Available in 50-sheet or 100-sheet pads, the form makes writing program line listings easy and filling the memory fun, the company said. It also explains the relationship of overlapping memory locations such as A, A$, A(01) and A$(01).

Pocket-BASIC Coding Form displays the computer's fixed memories side-by-side with a generous area for listing their contents. It also gives space for the programmer to label and list flexible memories. The face of the form has space for program title, programmer's name, date, page number, special notes and comments.

The reverse of the 8-1/2 × 11 inch form is precision ruled for 30 horizontal program lines, each divided by 80 vertical columns. Program lines are numbered in standard 10-300 line numbers in the margin for spotting at a glance. Vertical columns, left to right across the 11-inch width of the sheet, are

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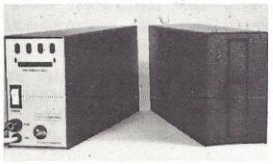

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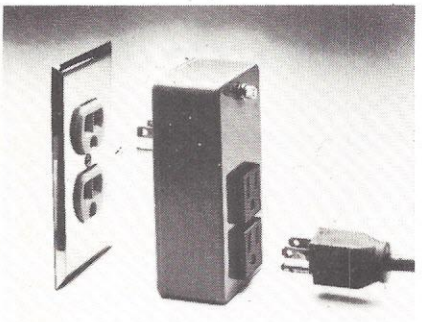

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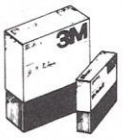

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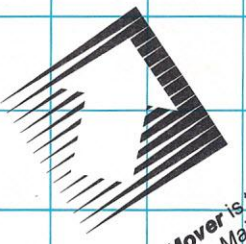

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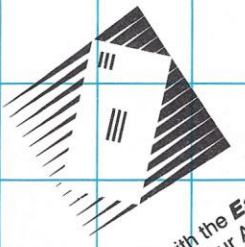

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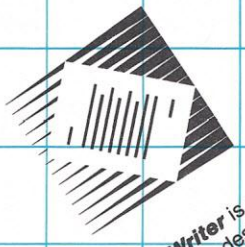

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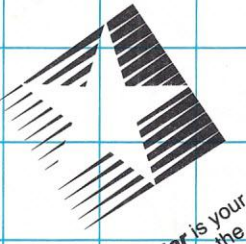

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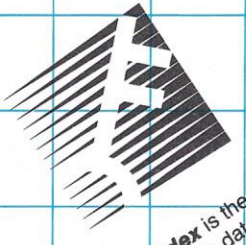

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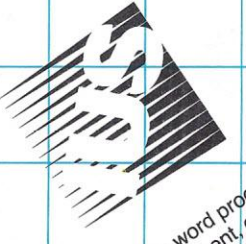

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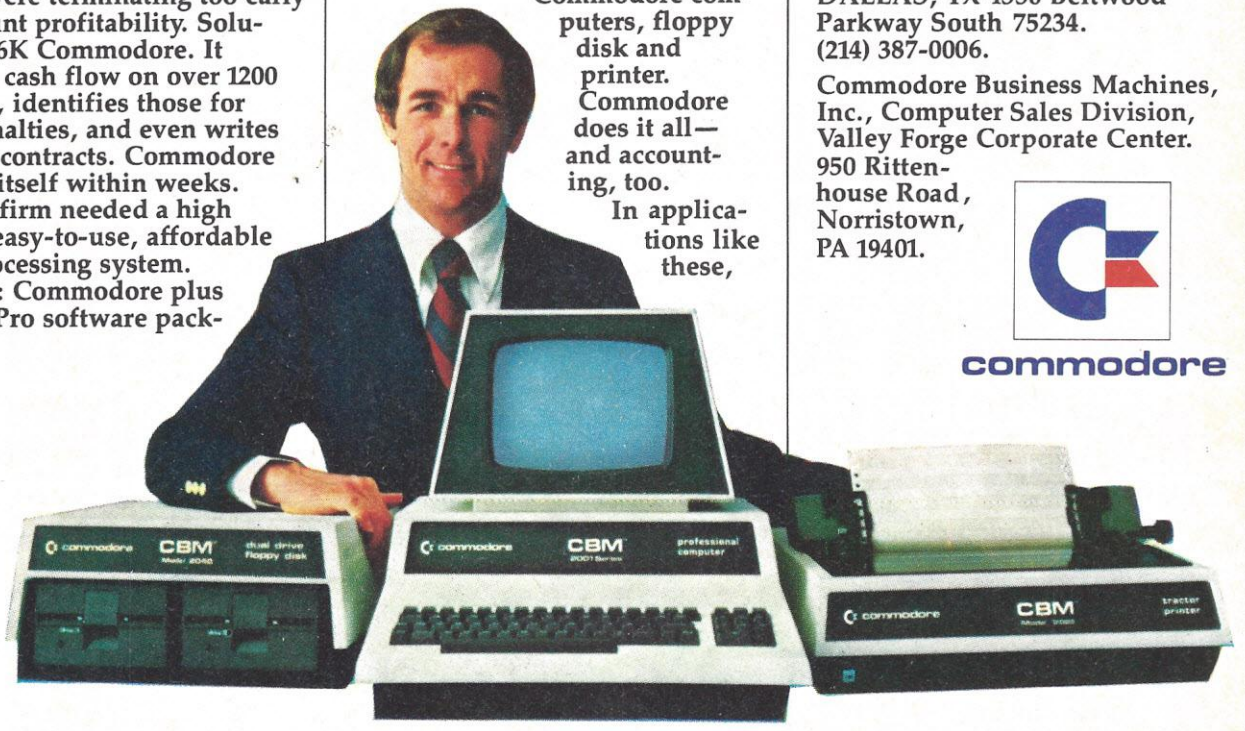

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